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PHOTOGRAPHS AND DESCRIPTIONS OF CUP-FUNGI—VIII. ELVELA INFULA AND GYROMITRA ESCULENTA

FRED J. SEAVER

(WITH PLATE 1)

There seems to be considerable confusion and diversity of opinion among students of Ascomycetes as to what constitute the real differences between[1] *Elvela infula* Schaeff. and *Gyromitra esculenta* (Pers.) Fries.

Schaeffer published two plates (159 and 160) in his illustrations of fungi which, although they received no specific names in the text, were labeled in the index *Elvela infula* and *Elvela Mitra* respectively, the latter being distinguished from the former by its more rugose hymenium. In 1800, Persoon, in his "Commentarius," retained the name *Elvela infula* in the same sense as used by Schaeffer, but *Elvela Mitra* was changed to *E. esculenta* since *E. Mitra* had been previously used by Linnaeus for an entirely different species.

In 1849 Fries established the genus *Gyromitra* on *Elvela esculenta,* this genus being distinguished from *Elvela* by the fact that the hymenium is gyrose with elevated ridges, essentially the same character used by Schaeffer in separating the species.

Rehm retained the genus *Gyromitra* for *Elvela esculenta* but also included *Elvela infula* in the genus, as had been previously done by Quélet, citing both plates (pp.) under each species, which would indicate, according to Rehm, that Schaeffer had mixed the

[1] The generic name has been variously spelled, *Elvela, Elvella,* and *Helvella.* In the present paper the original spelling is adopted.

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two species on both plates. If Rehm is correct in placing the two species in the same genus, there is no longer any reason for considering them specifically distinct since Fries used the same character in segregating the genus as had previously been used by Schaeffer in separating the species. *Gyromitra* can not then be regarded as a valid genus, since it was founded on a supposed difference which has been found to no longer exist.

Boudier retains the genus *Gyromitra,* but bases it on an entirely different character so as to exclude from the genus the very species on which it was founded. A new genus *Physomitra* is then proposed which includes the two species which he calls *Physomitra infula* and *Physomitra esculenta.* In his description of the last two species, there is a slight difference in the size of the spores, a difference, however, which had not been noted by previous authors.

While, to be sure, other differences have been pointed out by more recent authors in addition to those originally mentioned by Schaeffer and Fries, such as the shape of the pileus, the color, the attachment of the pileus to the stem, the inflation of the cap, etc., none of these characters appear to the writer to be any more fixed and reliable than the one originally mentioned. The type of the genus *Elvela* has the pileus more or less adnate to the stem, so that this character cannot be used as a distinguishing character between *Elvela* and *Gyromitra.* Even the original illustration of the type of the genus *Gyromitra* does not show the pileus completely attached to the stem at the margin, as might be inferred from many modern illustrations and descriptions. The inflation of the cap is a character which is common to both *Elvela infula* and *Gyromitra esculenta* and one which is most variable and misleading.

The difference in the rugosity or gyrosity of the hymenium might be accepted as a good specific and possibly generic character were it not for the fact that we often find all stages of gyrosity in specimens growing apparently from the same mycelium, and which we have no reason to believe do not represent the same species. It seems to the writer that it was a mistake to establish a genus on a character which is of very doubtful specific

value as was done in the case of *Gyromitra.* This is shown by the fact that no two modern writers seem to agree as to just what constitutes the difference between *Gyromitra esculenta* and *Elvela infula.*

In "Minnesota Helvellineae," Miss Hone lists *Elvela infula* but makes no mention of *Gyromitra esculenta.* She then appends an extended note explaining why she considers the Minnesota plant an *Elvela* instead of a *Gyromitra,* laying great stress on the absence of what she considers a true inflation of the cap, a character which has been ascribed to *Gyromitra* by Schroeter. Just what Schroeter would consider a true inflation of the cap is a question which mycologists seem unable to answer.

In the "Discomycetes of Wisconsin," Dodge lists *Elvela infula* but does not include *Gyromitra esculenta.* He apparently found no specimen in Wisconsin which would satisfy the requirements of *Gyromitra esculenta* as defined by modern authors.

The writer, in "Iowa Discomycetes," listed *Gyromitra esculenta,* but at that time knew nothing of *Elvela infula.* Yet the illustrations of the Minnesota and Iowa plants which have been placed in different genera might easily pass for the same species.

After a comparison of the above lists, the writer is convinced that the three authors are writing about the same plant but calling it by different names. Otherwise, why is it that the two species have never been reported from either of the three adjacent states which have such a close similarity in climate and natural conditions?

And European reports are equally puzzling. Rehm in his "Discomycetes of Europe" lists both *Gyromitra esculenta* and *G. infula,* but all of the exsiccati mentioned are included under the first. If the two forms are really distinct and both are represented in Europe, it seems strange that Rehm was unable to find any published exsiccati to illustrate the latter species.

After a careful examination of all the available facts, the writer is forced to conclude that *Gyromitra* is what some writers might call a traditional genus, having come down through literature and having been commonly accepted by mycologists but originally founded on a plant which cannot be specifically separated

from *Elvela infula.* The extreme variability of the species would readily account for all the different interpretations which have been assigned to the two supposed species by different mycologists. I therefore venture to combine the species and append a complete synonymy and description.

ELVELA INFULA Schaeff. Fung. Bavar. 4: Ind. 105. 1774.

?*Phallus Monacella* Scop. Fl. Carn. ed. 2, 2: 476. 1772.
Elvela Mitra Schaeff. Fung. Bavar. 4: Ind. 105. 1774. Not *E. Mitra* L.
Elvela brunnea L. Syst. Nat. 1450. 1796.
Helvella esculenta Pers. Comm. Fung. Bavar. 64. 1800.
Elvela infula Pers. Syn. Fung. 617. 1801.
Gyromitra esculenta Fries, Summa Veg. Scand. 346. 1849.
Elvela rhodopus Krombh. Abbild. 3: 23, 1834.
Gyromitra infula Quél. Ench. Fung. 272. 1886.
Gyromitra esculenta crispa Peck, Ann. Rep. N. Y. State Mus. 51: 299. 1898.
Physomitra infula Boud. Hist. Class. Discom. Eu. 35. 1907.
Physomitra esculenta Boud. Hist. Class. Discom. Eu. 35. 1907.

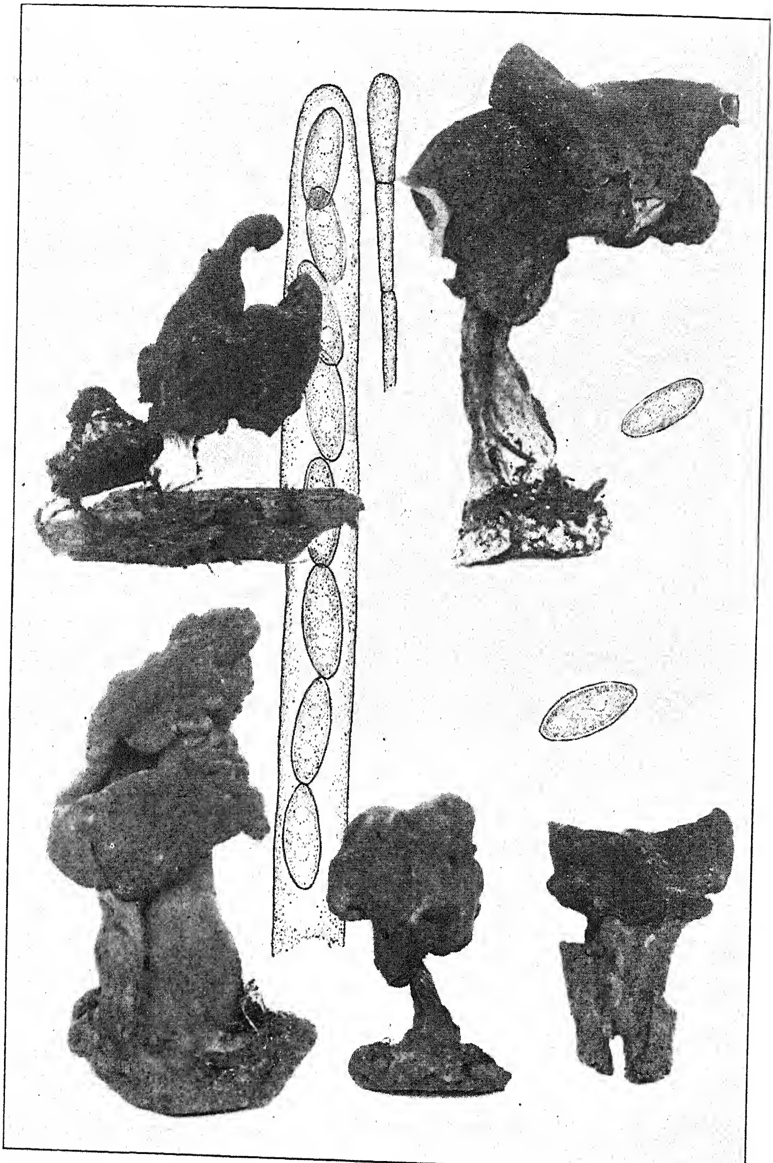
Pileus reaching a diameter of 6–8 cm., reflexed and more or less adnate to the stem, very irregular, mitrate, saddle-shaped or occasionally subglobose, even or variously contorted or convoluted, the color varying from reddish-brown to dark-brown and occasionally almost black; stem reaching a length of 6–8 cm. and a diameter of 5–15 mm.; even or more or less lacunose, never strongly fluted, the color varying from whitish to yellowish or occasionally with a pinkish tint; asci cylindric or subcylindric, reaching a length of 200 μ and a diameter of 12–14 μ, 8-spored; spores 1-seriate or partially 2-seriate, rather narrow-ellipsoid, containing two oil-drops, about 8–12 $\times$ 18–24 μ; paraphyses strongly enlarged at their apices, reaching a diameter of 10 μ.

On the ground or occasionally on rotton wood.

TYPE LOCALITY: *Europe.*

DISTRIBUTION: Maine to British Columbia and California.

ILLUSTRATIONS: Schaeff. Fung. Bavar. 4: *pl. 159, 161;* Rab. Krypt.-Fl. 1^3: 1174; *f. 1–3;* Boud. Ic. Myc. *pl. 223, 224;* Pers. Champ. Comest. *pl. 4;* Cooke, Hand. Brit. Fungi 2: 657, *f. 322;*



ELVELA INFULA SCHAEFF.

Cooke, Mycographia *pl. 89, f. 328* and *pl. 90, f. 330;* Gill. Champ. Fr. Discom., *pl. 19;* Massee, Brit. Fungus. Fl. 4: 188, *f. 14;* Phill. Brit. Discom. *pl. 1, f. 2;* E. & P. Nat. Pfl. 1^1: 44, *f. 141B;* Fries, Sv. Aetl. Svamp. *pl. 82 and 83;* Krombh. Abbild. *pl. 20, f. 6–12* and *pl. 21, f. 12–17;* Minn. Bot. Studies 3: *pl. 3, f. 1–3.*

EXSICCATI: N. Am. Fungi 1267; Clements. Crypt. Form. Colo. *141.*

NEW YORK BOTANICAL GARDEN.

EXPLANATION OF PLATE 1

Several plants photographed from dried specimens and about one-half natural size. The spores, ascus, and paraphysis were drawn with the aid of the camera lucida with a one-inch eye-piece and a one-sixth objective. The lower figure is the type of *E. oregonensis.*

CORRECTIONS AND ADDITIONS TO THE POLYPORES OF TEMPERATE NORTH AMERICA

William A. Murrill

During the dozen years or more that have elapsed since the publication of the two parts of *North American Flora* dealing with polypores, much additional information has been gained that is of value in determining the limitations and distribution of species, as well as the history and nomenclature of type collections. This knowledge has come to me through recent American collections in widely separated regions; through more and better specimens obtained from Europe; and through the increased knowledge and more enlightened opinions of other students of the family.

When I undertook the study of polypores, at the suggestion of Dr. Underwood, American collections were in very bad shape, and I afterwards found that European collections were not much better. This was particularly true of American specimens in European herbaria, because few foreign workers took any special interest in them, and they were incorrectly determined and carelessly handled. Through the valued assistance of American and European mycologists, our knowledge of these plants in America is now fairly accurate and complete, so far as the pileate forms are concerned, and I hope that the same may soon be said of the resupinate species.

The notes I have to make at this time deal largely with the nomenclature of temperate species already recognized, and with the addition of new species to our flora. The former will be taken up in the order in which they appear in *North American Flora;* while the latter will be appended in an alphabetical list of species, regardless of generic or other grouping.

HYDNOPORIA FUSCESCENS (Schw.) Murrill

Change to *Hydnochaete olivacea* (Schw.) Banker, as published in Mycologia 6: 234. 1914. This species remains in the Polyporaceae.

FOMITIPORIA DRYOPHILA Murrill

Probably not distinct from *Pyropolyporus Calkinsii* Murrill.

CORIOLUS HIRSUTULUS (Schw.) Murrill.

Only a form of *Coriolus versicolor* (L.) Quél.

CORIOLUS PUBESCENS (Schum.) Murrill

Add to synonymy *P. Grayii* Cooke.

CORIOLUS BALSAMEUS (Peck) Murrill

This species has been recombined as *Tyromyces balsameus* (Peck) Murrill.

CORIOLUS LLOYDII Murrill

This may be only a form of the variable *Coriolus pubescens* (Schum.) Murrill.

CORIOLUS PINSITUS (Fries) Pat.

Add to synonymy *Boletus villosus* Sw. Prodr. 148. 1788. Not *B. villosus* Huds.

CORIOLUS BIFORMIS Murrill

Polyporus biformis Klotzsch having been wrongly interpreted. *Coriolus molliusculus* (Berk.) Murrill was adopted in "Northern Polypores" for this species. According to Bresadola, who has sent me excellent specimens to support his opinion, *Trametes populina* (Schulz.) Bres. is not distinct from *C. molliusculus*. If true, then his name would have priority unless the doubtful *Boletus cervinus* Schw. could be shown to be the same thing.

CORIOLUS PROLIFICANS (Fries) Murrill

Change to *Coriolus biformis* (Klotzsch) Pat. (*Polyporus biformis* Klotzsch, Linnaea 8: 486. 1833).

CORIOLELLUS SEPIUM (Berk.) Murrill

Add to synonymy *Trametes minima,* a manuscript name of Berkeley's recently published for the small, undeveloped form so common on oak, chestnut, etc.

TYROMYCES GUTTULATUS (Peck) Murrill

According to Bresadola, this is not distinct from *Polyporus alutaceus* Fries.

TYROMYCES SMALLII Murrill

Polyporus pini-ponderosae Long, recently described from New Mexico, does not appear to be distinct.

TYROMYCES TILIOPHILA Murrill

Although of large size and found on hardwood, this species should be carefully compared with *T. guttulatus* (Peck) Murrill and *Polyporus alutaceus* Fries.

TYROMYCES CRISPELLUS (Peck) Murrill

A synonym of *T. balsameus* (Peck) Murrill, as stated in Jour. N. Y. Bot. Gard. 13: 177. 1912.

SPONGIPELLIS GALACTINUS (Berk.) Pat.

I have seen no specimens from America that correspond to *Spongipellis spumeus* of Europe. *Trametes malicola* Berk. & Curt. is said to be distinct from *S. galactinus,* under which I doubtfully placed it as a synonym.

BJERKANDERA PUBERULA (Berk. & Curt.) Murrill

Not sufficiently distinct from *B. fumosa* (Pers.) P. Karst.

HEXAGONA ALVEOLARIS (DC.) Murrill

Add to synonymy *Favolus Kauffmanii* and *Favolus Whetstoneae,* both published by Lloyd in Myc. Notes 44: 1916.

HEXAGONA STRIATULA (Ellis & Ev.) Murrill

This may be only a variety of *H. alveolaris* (DC.) Murrill.

MICROPORELLUS DEALBUTUS (Berk. & Curt.) Murrill

I found a plant in North Carolina and I also have one from Auburn, Alabama, collected by Earle and Baker, which appear to be quite distinct from the one usually called *M. dealbata.* It is claimed that there has been some mistake at Kew and that this thicker plant, often with central stipe, should be called *Polyporus dealbatus* and the more common one *P. mutabilis*. If this is true, it would necessitate not only a change of name but also a change in my generic treatment.

POLYPORUS CRATERELLUS Berk. & Curt.

It is probable that *P. cyathiformis* Lév. is not distinct. If so, this name should be taken up. *P. confusus* Massee is a closely related species recently described from Louisiana.

POLYPORUS COLUMBIENSIS Berk.

This species occurs in Oregon rather than in South Carolina.

POLYPORUS HUMILIS Peck

Compare *Polyporus fractipes* Berk. & Curt.

POLYPORUS ARCULARIFORMIS Murrill

Only a small form of *P. arcularius* (Batsch) Fries.

POLYPORUS AMYGDALINUS Berk. & Rav.

An excellent specimen of this rather imperfectly known species was recently sent in from Montgomery, Alabama, by Dr. R. P. Burke. See list of additions.

SCUTIGER RETIPES (Underw.) Murrill

Apparently not distinct from specimens of *Polyporus pes-caprae* collected by Bresadola in Italy. It is reported from New Jersey and North Carolina, as well as from Alabama.

SCUTIGER HOLOCYANEUS (Atk.) Murrill

This can hardly be distinct from *S. caeruleoporus* (Peck) Murrill, although I have never been able to compare the types.

SCUTIGER RADICATUS (Schw.) Murrill

See "Western Polypores" for a descriptive account of *Scutiger hispidellus* (Peck) Murrill, which is distinct from *Scutiger radicatus*. It is claimed that *P. Kansensis* is also distinct, on the ground that it is different in habit and also has different spores.

SCUTIGER PERSICINUS (Berk. & Curt.) Murrill

Compare "Southern Polypores" for notes on a recent collection of this species.

SCUTIGER WHITEAE Murrill

This is the representative of *Polyporus confluens* (Alb. & Schw.) Fries in America. It is pale-colored when fresh, resembling *P. ovinus,* but turns reddish instead of gray in the herbarium. I have it from Tolland, Colorado; Banff, Canada; and Hague, New York; as well as from Maine.

GRIFOLA PORIPES (Fries) Murrill

Change to *Grifola cristata* (Schaeff.) S. F. Gray. Several collections received from Europe show that the American plant is not distinct. It was first described and figured by Schaeffer (Fung. Bavar. Ind. 81. *pl. 113.* 1774) under the name of *Boletus flabelliformis,* which he later changed to *Boletus cristatus* (Fung. Bavar. Ind. 93. *pl. 316, 317.* 1774). *Boletus flabelliformis* was used by Scopoli in 1770 for a different plant.

GRIFOLA SUMSTINEI Murrill

Change to **Grifola mesenterica** (Schaeff.) Murrill. Originally described as *Boletus mesentericus* by Schaeffer (Fung. Bavar. Ind. 91. *pl. 267.* 1774) and renamed *Boletus giganteus* by Persoon.

GRIFOLA FRONDOSA (Dicks.) S. F. Gray

Some claim that *Polyporus intybaceus* is distinct. Practically all the specimens so labeled, however, are *G. frondosa.*

GRIFOLA BERKELEYI (Fries) Murrill

Strange as it may seem, this oak-loving species grows on conifers in the west, attacking the roots of *Abies* and even occurring on dead fir wood. Dr. Weir has sent me specimens from Idaho and I have recently received a collection from Corvallis, Oregon, found by Mr. C. E. Owens at the base of a living *Abies grandis* on October 28. The surface of the western specimens is quite reticulate, but they do not appear to be specifically distinct.

GRIFOLA FRACTIPES (Berk. & Curt.) Murrill

This was changed to *Grifola Peckiana* (Cooke) Murrill in "Northern Polypores." *Polyporus fractipes* Berk. & Curt., described from South Carolina, appears to be a different thing, closely related to *P. humilis* Peck.

AURANTIPORUS PILOTAE (Schw.) Murrill

Change to **Aurantiporus croceus** (Pers.) Murrill (*Polyporus croceus* Pers. Obs. Myc. 1: 87. 1796). *Polyporus Pini-canadensis* Schw. can hardly be a synonym of this species.

LAETIPORUS SPECIOSUS (Batt.) Murrill

Change to **Laetiporus sulphureus** (Bull.) Murrill (*Boletus sulphureus* Bull. Herb. Fr. *pl. 429.* 1788). It has been decided that Battarra was a non-binomial author, although some of his names happened to be binomial in form.

FUNALIA VILLOSA (Sw.) Murrill

Change to *Funalia versatilis* (Berk.) Murrill. *Boletus villosus* Sw. is *Coriolus pinsitus* (Fries) Pat., but Swartz's name cannot be used because *B. villosus* Huds. is prior.

FUNALIA STUPPEA (Berk.) Murrill

According to specimens from Bresadola, *Trametes hispida* Bagl. and *Trametes Trogii subresupinata* are not distinct. According to Maire, the name *Trametes extenuata* (Mont.) Pat. is to be preferred. Roumeguère calls the same plant *Trametes hexagonoides* Fries.

HAPALOPILUS SUBLILACINUS (Ellis & Ev.) Murrill

Apparently not distinct from *Hapalopilus gilvus* (Schw.) Murrill.

HAPALOPILUS GILVUS (Schw.) Murrill

Polyporus Hookerii, a manuscript name of Berkeley's recently published, is synonymous. *Polyporus calvescens* Berk. is not a synonym. *Trametes Petersii* Berk. & Curt. is also very probably distinct.

INONOTUS HIRSUTUS (Scop.) Murrill

Polyporus Bankeri C. G. Lloyd is not distinct, according to Lloyd.

INONOTUS DRYOPHILUS (Berk.) Murrill

Said to be the same as *Polyporus rheades* Pers. (Myc. Eur. 2: 69. 1825), found on trunks in France, and synonymous with or very closely related to *Polyporus coruscans* Fries and other European species.

INONOTUS PERPLEXUS (Peck) Murrill

Change to *Inonotus cuticularis* (Bull.) P. Karst. (*Boletus cuticularis* Bull. Herb. Fr. *pl. 462.* 1789).

INONOTUS AMPLECTENS Murrill

If the type of *Inonotus fruticum* (Berk. & Curt.) Murrill was collected on *Asimina,* then *I. amplectens* is probably not distinct from it.

INONOTUS RADIATUS (Sow.) P. Karst.

Polyporus glomeratus Peck is a distinct species.

COLTRICIA PERENNIS (L.) Murrill

Polyporus prolificans C. G. Lloyd is said to be a synonym.

COLTRICIA TOMENTOSA (Fries) Murrill

Regarding *Polyporus dualis,* Peck published the following:

"In Sylloge, Vol. vi, p. 208, this fungus has been united with *P. circinatus,* to which it is similar in color and texture, but from which it differs in its shape and habitat. It is dimidiate and stemless, or with only a lateral short stem-like base, and grows from the sides of stumps or dead trunks of spruce or pine trees. The dried specimens are also a little more highly colored than those of *P. circinatus.* It does not seem right to disregard entirely such differences, and I am unwilling to follow the plan of Sylloge in considering this plant identical with *P. circinatus.* It is at least worthy of varietal distinction, and may stand under the name *P. circinatus* Fr. var. *dualis* Pk."

COLTRICIA OBESA (Ellis & Ev.) Murrill

Change to **Coltricia Montagnei** (Fries) Murrill (*Polyporus Montagnei* Fries; Mont. Ann. Sci. Nat. II. 5: 341. 1836).

CRYPTOPORUS VOLVATUS (Peck) Shear

In my "Northern Polypores" and "Western Polypores," Hubbard instead of Shear was incorrectly cited as the authority both for the generic name and the specific combination.

FOMES ROSEUS (Alb. & Schw.) Cooke

It is claimed by some that the plant called *Polyporus carneus* in this country is distinct, being thin and annual, while the true *Fomes roseus* is ungulate. Compare variations occurring in *Porodaedalea Pini* (Thore) Murrill.

PYROPOLYPORUS Murrill

Species of this genus having ferruginous or fulvous spores were transferred to the new genus, *Fulvifomes* Murrill, in "Northern Polypores," "Southern Polypores," "Western Polypores," and "Tropical Polypores."

PYROPOLYPORUS BAKERI Murrill

Specimens of *Fomes Hartigii* from Bresadola appear very similar on first sight, but are probably distinct. Compare also *Fomes robustus.*

PYROPOLYPORUS PRAERIMOSUS Murrill

Not specifically distinct from *Fulvifomes Everhartii* (Ellis & Gall.) Murrill.

PYROPOLYPORUS JUNIPERINUS (Schrenk) Murrill

Fomes Demidoffii is said to be the same thing. If so, this name will have to be taken up, since it is much older. According to Saccardo, *Fomes Demidoffii* Lév. occurs "ad truncos Juniperi excelsae in Europa et Pini silvestris pr. Minussink Sibiriae Asiaticae." The description agrees fairly well with that of *P. juniperinus*.

PYROPOLYORUS EARLEI Murrill

Not specifically distinct from *Fulvifomes juniperinus* (Schrenk) Murrill.

GLOBIFOMES GRAVEOLENS (Schw.) Murrill

Polyporus botryoides Lév. is probably not distinct.

ELFVINGIA P. Karst.

Species having hyaline or subhyaline spores were transferred to the new genus, *Elfvingiella* Murrill, in "Northern Polypores," "Southern Polypores," "Western Polypores," and "Tropical Polypores."

ELFVINGIA FASCIATA (Sw.) Murrill

The validity of the specific name is in doubt and it may be advisable to use the combination **Elfvingiella marmorata** (Berk. & Curt.) Murrill for this species.

ELFVINGIA MEGALOMA (Lév.) Murrill

Many authors prefer *Fomes applanatus* for this species, claiming that there is no specific difference between the American and European plants. The earliest name for *Fomes applanatus* is *Boletus lipsiensis* Batsch, 1786, and this was taken up in 1903 as *Elfvingia lipsiensis* (Batsch) Murrill.

GANODERMA SESSILE Murrill

The type of this species is large and entirely sessile, but a great many forms have been collected since it was described that are furnished with long stipes and seem to connect it up with *Polyporus lucidus* of Europe (*Ganoderma pseudoboletus* (Jacq.) Murrill). According to some authors, *Ganoderma subperforatum* Atk. is not distinct. The genus is a very difficult one and still requires considerable field work before the limitations of the species are accurately known.

DAEDALEA AESCULI (Schw.) Murrill

Use the name *Daedalea ambigua* Berk. for this species.

GLOEOPHYLLUM HIRSUTUM (Schaeff.) Murrill

Overholts includes *Trametes protracta* Fries as an American species, but says that some consider it only a poroid form of *G. hirsutum,* which it much resembles.

LIST OF ADDITIONS

ABRAMSIANUS. *Pyropolyporus Abramsianus* Murrill, Western Polypores 26. 1915. Collected several times in California.

ADUNCUS. *Polyporus aduncus* C. G. Lloyd, Letter No. 56: 5; Syn. Apus Pol. 354. 1915. Type not seen. Belongs in *Inonotus.*

"Pileus dimidiate, 1 cm. thick, unicolorous brown. Surface with coarse, brown, hispid hairs. Context brown. Pores small, round, brown. Setae few, large, 8–10 × 60–75 μ, deeply colored, with peculiar, hooked points. Spores hyaline, smooth, 4 × 5–6 μ, not guttulate. Spores are a little larger than Polyporus leporinus, but otherwise it is exactly the same, excepting the surface, which is quite different. It is very rare, only known from one specimen from E. K. Abbott, Monterey, California, and grew on the roots of a pine tree. To the eye it resembles Polyporus cuticularis, but has no relation to it otherwise."

AMARUS. *Fomes amarus* (Hedgcock) Murrill, Western Polypores 25. 1915. Found on incense cedar in Oregon and California.

AMORPHUS. *Tyromyces amorphus* (Fries) Murrill, Mycologia 10: 109. *pl. 6, f. 5.* 1918. Rare on conifers in northern regions.

AMYGDALINUS. *Polyporus amygdalinus* Berk. & Rav.; Berk. Grevillea 1: 49. 1872. Described from South Carolina, on oak, and poorly represented until Dr. R. P. Burke recently sent me splendid specimens from Alabama. They suggest *Laetiporus sulphureus,* but are not brilliantly colored and the context is very soft corky instead of rigid when dry.

ARCTOSTAPHYLI. *Fomes Arctostaphyli* Long. Compare depauperate forms of *Pyropolyporus igniarius.*

AURICULATUS. *Pseudofavolus auriculatus* Pat. Bull. Soc. Myc. Fr. 24: 4. 1908. Described from Louisiana and said to resemble *Hexagona cucullata* (Mont.) Murrill.

BOREALIS. *Fomes borealis* C. G. Floyd, Syn. Fomes 247. 1915. Type not seen. Apparently a species of *Pyropolyporus.*

"Pileus ungulate, with a thin, pale, smooth, hard crust, variegated with darker spots. Context hard, dark brown (amber brown). Setae slender, numerous, dense. Spores hyaline, globose, 6 μ.

"I found this on the birch at Temagami, Ontario. It is closely related to igniarius and nigricans. The marked feature is the dense setae on the hymenium."

BROWNII. *Elfvingia Brownii* Murrill, Western Polypores 29. 1915. Found in California.

CAESIOSIMULANS. *Tyromyces caesiosimulans* Atk. Ann. Myc. 6: 61. 1908. Said to be near *T. caesius,* but to have globose, pedicellate spores.

CALVESCENS. *Polyporus calvescens* Berk. Ann. Nat. Hist. 3: 390. 1839. Described from New Orleans, Louisiana, and not since collected.

CARBONARIUS. See *Tyromyces carbonarius* Murrill in Western Polypores, p. 8.

CONFLUENS. *Polyporus confluens* (Alb. & Schw.) Fries. I have examined many specimens in herbaria and have studied fresh plants with Bresadola at Mendel Pass, but nothing I have seen from America seems to match it. It is pale-red at first, becoming almost as brilliantly colored as *Hypomyces lactifluorum.* Mr. Lloyd reports having seen a specimen from Massachusetts collected by Mrs. Blackford.

CONFUSUS. *Polyporus confusus* Mass. Kew Bull. 1910: 250. 1910. Described from Louisiana. See "Southern Polypores," p. 22. Closely related to *Polyporus cyathiformis* Lév.

CONGLOMERUS. *Polystictus conglomerus* C. G. Lloyd, Myc. Notes 50: 706. *f. 1056.* 1917. Type not seen, but doubtless belongs in *Coriolus*.

"Pileus thin, rigid, developed from a hard, white, conglomerate, myceloid base. Surface unicolorous, between isabelline and honey yellow, velvety with soft hairs, faintly zoned. Pores minute, rigid, alutaceous. Spores 3 × 5, hyaline.

"The feature of this plant is the method of development from a conglomerate base, unknown to me in any other species. The rigid pileus and pores point to Trametes, but it is customary to refer such thin plants to Polystictus. In grouping it we would put the species in the same section as versicolor. The specimens were sent to Mr. Plitt by Dr. H. E. Hone from California."

CUTIFRACTUS. See *Tyromyces cutifractus* Murrill in Western Polypores, p. 7.

CYLINDRISPORA. *Poria* (or *Fomes*) *cylindrispora* C. G. Lloyd, Letter 65: 9. March, 1917. **Fomitiporia cylindrispora** (Lloyd) Murrill. Type not seen. Described from Weir's collection in Montana.

"Perennial, resupinate, ½–1 inch thick. Context ferruginous (about snuff brown Ridgway). Pores minute, with silvery glancing mouths. Pore layer narrow, 2–3 mm. wide. Setae abundant, slender, not inflated at base. Spores hyaline, cylindrical, 2½–3 × 6–7, smooth.

"Mr. Weir finds this abundant on Quercus Garryana. To the eye it is same as the common Poria punctata (Poria obliqua of American traditions, not Europe), but no other known similar species has cylindrical spores."

EPILEUCUS. Not American, so far as I know.

FARLOWII. *Polyporus Farlowii* C. G. Lloyd, Syn. Apus Pol. 363. *f. 697.* 1915. Type not seen. Apparently belongs in *Inonotus*.

"Pileus applanate, wavy. Surface strongly hispid, with suberect, brown hairs. Context hard, ferruginous, brown (antique brown), fibrillose. Pores small, round, firm, concolorous. Setae abundant, straight, projecting 30 μ. Spores colored, ellipitical, 2½ × 4½–5.

"The type at Kew was collected in Arizona and, according to the label, sent by Farlow to Cooke, who determined it as Polyporus endocrocinus. The yellow coloring matter is not soluble in water, but readily so in a potash solution. This must be an unusual species in our Western States. It has never reached us, nor is it found at New York."

FLORIFORMIS. Reported from America, but I have seen no American specimens that match those from Europe.

FRACTIPES. *Polyporus fractipes* Berk. & Curt. Grevillea 1: 38. 1872. Collected a few times in South Carolina and Louisiana. *Polyporus humilis* Peck is closely related.

FRAGILIS. *Spongipellis fragilis* (Fries) Murrill, Southern Polypores 61. 1915. I have European specimens from Bresadola and Karsten and American specimens collected by Atkinson at Ithaca and in North Carolina, and by myself at Ohio Pyle, Pennsylvania, and at Lake Placid, New York. Fungi Columb. *4749*, collected at London, Canada, by Dearness, and distributed as *P. mollis* (Pers.) Fries is not distinct. Peck got it at Pine Hill, New York, and called it *P. Weinmanni* Fries. Compare Fries Icon. *pl. 182, f. 2.* My *Spongipellis sensibilis*, from the West, is closely related.

FUMIDICEPS. *Tyromyces fumidiceps* Atk. Ann. Myc. 6: 61. 1908. Said to be near *T. chioneus*, but to have a darked pileus and very different spores.

GILVOIDES. *Trametes gilvoides* C. G. Lloyd, Myc. Notes 38: 520. *f. 516.* 1912. Collected by Lloyd on an oak branch in Florida in January, 1897, and never seen elsewhere by him. I have not seen the type, but it apparently belongs to *Pogonomyces.*

"Entire plant gilvous brown, pileus subresupinate, adnate, the surface of the pileus covered with rigid, brown setae in the same manner as those of *Trametes hydnoides.* Context gilvous brown. Hymenium with numerous slender setae of the "Hymenochaete" type. Pores small, round, with glancing mouths. Spores globose, $2\frac{1}{2} \times 3\ \mu$, hyaline (or perhaps pale colored)."

GLOMERATUS. *Polyporus glomeratus* Peck, Ann. Rep. N. Y. State Mus. 24: 78. 1873. **Inonotus glomeratus** (Peck) Murrill. Distinguished from *Inonotus radiatus* by its more resupinate habit and peculiar cystidia.

GRANTII. Polyporus Grantii C. G. Lloyd, Myc. Notes 53: 763. *f. 1147.* 1918. Type not seen.

"White, spathulate to a rooting base. Surface smooth, apparently a little glutinose when fresh. Context white, hard. Pores minute, white. Spores (if correctly seen) globose, 6–7 mic., minutely rough.

"Based on a single half specimen (62) from J. M. Grant, Washington. It grew on a log. At first I thought it was *Polyporus osseus,* one of our rare

species, which with us is usually greyish, but in Europe is white, but the spores of the two species are entirely different, if I see them correctly. The habitat also differs. When fresh the plant was probably slightly viscid as Abies needles are adherent to the surface."

HETEROMORPHA. *Daedalea heteromorpha* Fries, Obs. Myc. 1: 108. 1815. Overholts thinks we have this or a closely related species in America. He cites a specimen from Idaho with hymenium partly lamellate and partly poroid and spores cylindric, hyaline, 9–11 × 3–4 μ. Lloyd in Myc. Notes. 59, 1919, gives several figures of this plant, practically all of which show large, irregular pores like those of *Coriolellus sepium,* to which species I have been referring the above forms. According to Lloyd, his *Trametes lacerata* and *Coriolellus sepium* are both practically the same as *Daedalea heteromorpha.*

HISPIDELLUS. *Scutiger hispidellus* (Peck) Murrill, Western Polypores 16. 1915. It is quite distinct from *Scutiger radicatus* (Schw.) Murrill. I have recently received excellent specimens from the state of Washington. According to Lloyd, the species is not distinct from *Polyporus hirtus* Quél. of Europe. In support of his opinion, I find the dried specimens bitter, as described by Quélet; and it has been my experience that species occurring both in the northeastern United States and in the extreme Northwest are rather apt to be found also in Europe and around the world in northern regions. This distribution, of course, dates back to land connections and a different climate.

KREKEI. *Trametes Krekei* C. G. Lloyd, Letter No. 69: 12. 1919. Type not seen. Compare *Coriolellus serialis* and *Trametes Morganii.*

"Pileate with narrow pileate development, but very long, decurrent pores. Color pale reddish. Pores large, angular. Spores abundant, globose, 6 × 7 μ.

"The receipt of this fine specimen which was unfamiliar to me led to the study of the unnamed Trametes that have accumulated and the publication of *Trametes Morganii.* It is very similar to Morganii to the eye (but not the same), but the spores are entirely different. Rev. Kreke collected it in Franklin County, Indiana, and it must be rare, for I have no other specimen."

LEEI. *Inonotus Leei* Murrill, Western Polypores 21. 1915. Found on oak in California.

LUDOVICIANUS. *Inonotus ludovicianus* (Pat.) Murrill, Southern Polypores 41. 1915. On oak wood in South Carolina and Louisiana. It is a near relative of *Inonotus cuticularis.*

MALICOLA. *Trametes malicola* Berk. & Curt. Jour. Acad. Phila. II. 3: 209. 1856. **Coriolellus malicola** (Berk. & Curt.) Murrill. There are many dried specimens of this plant in the Garden herbarium which have seemed to connect up rather closely with small-pored forms of *Coriolellus sepium.* At Yama Farms, November 8, 1919, I collected several fresh specimens on apple-tree logs.

McMURPHYI. *Polyporus McMurphyi* Murrill, Western Polypores 12. 1915. Found in California.

MERISMA. *Trametes merisma* Peck, Bull. N. Y. State Mus. 139: 31. 1910. Pendant from fallen beech trunks.

MORGANII. *Trametes Morganii* C. G. Lloyd, Letter No. 69: 15. 1919. This plant was incorrectly called *Trametes rigida* by Morgan. I have specimens of it, to which I several years ago assigned a manuscript name but never published it because it seemed to me too near to *Coriolellus serialis.* According to Lloyd, who describes it at length in the letter cited above, the same thing occurs under other names in Europe, where it is spore-bearing and always resupinate. He objects to Romell's name, *Polyporus albocarneogilvidus,* as being too long,—and one can hardly blame him.

OREGONENSIS. See *Scutiger oregonensis* Murrill in Western Polypores, p. 15.

OSSEUS. *Polyporus osseus* Kalchb. Enum 1, p. 160. Occasional northward. See "Western Polypores," p. 13.

OVINUS. *Polyporus ovinus* (Schaeff.) Fries. **Scutiger ovinus** (Schaeff.) Murrill. I have two American collections which I have referred to this species, one from Alabama sent by Dr. Burke, and one made by myself on a shady bank in coniferous woods at Camp Kanosa in the Adirondacks. The latter specimens were white beneath and pale-rosy-isabelline above, becoming rather gray in the herbarium and resembling *Scutiger griseus* (Peck) Murrill. *Scutiger Whiteae* Murrill is nearer *P. confluens.*

PENNSYLVANICUS. *Polyporus pennsylvanicus* Sumstine, Jour. Myc. 13: 137. 1907. Reported also from Ohio and elsewhere, some of the specimens having been called *P. pallidus*. It has smaller scales than *P. caudicinus*.

PERDELICATUS. See *Tyromyces perdelicatus* Murrill in Western Polypores, p. 9.

PETERSII. *Trametes Petersii* Berk. & Curt. Grevillea 1: 66. 1872. Described from Alabama and not since collected. See "Southern Polypores," p. 61.

PSEUDOTSUGAE. See *Tyromyces Pseudotsugae* Murrill in Western Polypores, p. 9.

PUSILLUS. *Trametes pusillus* C. G. Lloyd, Myc. Notes 54: 774. *f. 1165*. 1918. Collected in Minnesota by Dr. S. M. Stocker. Type not seen.

"Pileus small, 1–1½ cm., dimidiate, white. Margin acute. Surface dull, faintly greyish, unzoned, very minutely pubescent. Pores white, small, round, rigid, with white mouths. Cystidia none. Spores cylindrical, hyaline, smooth, $3 \times 6\,\mu$.

"When I first saw this collection I thought of *Fomes Ohiensis* (cf. Fomes Synopsis p. 218), but it did not look exactly right. The spores I found were entirely different. I do not know of any other species, excepting *Fomes Ohiensis* with which it can be confused. The pores are not in strata, hence these specimens are not Fomes, but the species may turn out to be a Fomes, the same as *Fomes Ohiensis*, which was thought at first to be a Trametes. The plant is quite close to a form of *Trametes sepium* we often find with little pilei, but its habits are different and its pores much smaller."

PUTEARIUS. *Fomes putearius* Weir, Jour. Agric. Research 2: 163. *pl. 9*. 1914. Described from the Northwest on coniferous wood, with a preference for larch. I have before me specimens from Weir which appear to match in every particular specimens collected by Bresadola on fir near Trient and labeled "*Fomes spongiosus* Pers. (=*Fomes tenuis* Karsten)." Compare *Boletus spongiosus* Pers. Syn. Fung. 543 and *Boletus resupinatus* Bolton, Hist. Fung. 165. *pl. 165*. It is interesting to have this species so well worked up by Mr. Weir for America.

"Sporophores hard, woody, very irregularly lobed, recurving, slightly conchate to applanate, occasionally broadly spreading to typically resupinate. The resupinate sporophores are often a foot or more in length. Pileate forms 12

to 14 by 6 to 8 by 0.4 cm. The surface in young specimens is velvety or tomentose, later becoming slightly incrusted, but always more or less corky, zonate; much wrinkled and furrowed in old age, in color deep brown, becoming darker; margin lighter colored, undulate, tomentose, thin, with narrow sterile border when young, later becoming thickened, rounded, and recurved by the successive annual layers; context corky to woody, thick deep brown; tubes irregularly but distinctly stratified 2 to 3 mm. long each season, but much longer in resupinate forms, brown; mouths uniformly oval, varying in size, 4 to 8 to a millimeter, edges thick, ferruginous; spores colored, globose, smooth, 7 to 8 μ; spines dark brown, slightly ventricose 13 to 25 by 6 μ."

RIGIDUS. *Polyporus rigidus* Lév. Ann. Sci. Nat. III. 2: 189. 1844. It is claimed that this Javan species, which somewhat resembles *Rigidoporus surinamensis,* occurs in Missouri and Florida. I have not seen the American collections upon which this claim is based.

SENSIBILIS. See *Spongipellis sensibilis* Murrill in Western Polypores, p. 10. Closely related to *Spongipellis fragilis* (Fries) Murrill.

SETOSUS. *Trametes setosus* Weir, Jour. Agric. Research 2: 164. *pl. 10.* 1914. Described from Idaho on *Pinus monticola,* and said to be destructive to coniferous wood in the Northwest from Vancouver, B. C., to Montana. Compare small, poroid forms of *Porodaedalea Pini* (Thore) Murrill.

"Sporophores pileate or entirely resupinate, depending upon its position in the substratum. The resupinate forms have sharply defined sterile margins and are usually found on the underside of logs, where they may extend for a distance of a foot or more. The distinctly sessile pileate forms are usually free from each other, but may be connected by the resupinate portion, occasionally narrowed at the point of attachment, mostly thickened at the base, rarely applanate or conchate, averaging 1 by 2 by 2 cm. Surface minutely tomentose, becoming smooth or weathered in old specimens, zonate, rich dark brown, uneven; margin thick, of lighter color, entire, becoming slightly serrate in old age, slightly sterile; context ferruginous or fulvous, spongy to corky, slightly zonate, particularly in old specimens; tubes long, often filled with a grayish mycelium, 1 to 1.5 mm.; mouths small, mostly angular, occasionally labyrinth-like, 3 to 6 to a millimeter, edges thick, tomentose; spores hyaline, 4 to 5 by 3 μ. The character that distinguishes the species from all of its near relatives is the immense number of long dense brown setae lining the interior of the tubes. In no other species known to the writer is this character so distinctly pronounced. The longest spines measure 41.45 μ, the shortest about 22.16 μ, with an average of 30.46 μ. The nature and immense number of these setae may be determined by a study of Plate X, figure II."

SMARAGDINUS. *Polyporus smaragdinus* C. G. Lloyd, Myc. Notes 58: 818. *f. 1365*. 1919. Collected by Dr. J. F. Brenckle on a sycamore log in Arkansas. Type not seen.

"'Pileus dimidiate, 1–2 inches thick. Surface dull, uneven, with thin, buff cuticle. Context white, hard when dry. Pores minute, 4–6 mm. deep, with pale greenish tissue and brown mouths. Cystidia none. Spores globose, hyaline, 6 μ. Conidial spores abundant, small, subglobose, 2–3 μ, hyaline.

"The colors are those of the dried specimen. I judge that of the pore mouths has changed in drying. The pale green pore tissue is an unusual feature. I do not recall it in any other species."

SPUMEUS. This species has several times been reported, but I have seen no American specimens that correspond with those I have from Europe.

SUBPENDULUS. *Tyromyces subpendulus* Atk. Ann. Myc. 6: 61. 1908. On hemlock; resembling *Porodisculus pendulus* in shape. Type not seen.

SUBSTIPITATUS. See *Tyromyces substipitatus* Murrill in Western Polypores, p. 9.

TEPHROLEUCUS. Reported from America, but I have seen no American specimens that correspond with European material.

TORULOSUS. *Fomes torulosus* Pers. Reported by Lloyd from Louisiana, growing on live oak. He says that *Fomes fuscopurpureus* Boudier, *pl. 152*, is the same thing and that the spores are hyaline. I have not seen the Louisiana specimens, unless they were some I determined for Edgerton as *Hapalopilus licnoides*. This species gets quite thick at times and appears to be perennial.

URSINUS. *Polyporus ursinus* C. G. Lloyd, Syn. Apus Pol. 319. *f. 659, 660*. 1915. Type not seen. Compare the description carefully with *Spongipellis fragilis* (Fries) Murrill.

"Pileus dimidiate (1 × 5 × 7 cm.), white, but turning reddish when bruised and on drying. Surface strongly scrupose, tomentose, with rigid, tufted hairs, which have the same color change as the flesh. Flesh white, soft when fresh, but drying firm and hard. Pores medium large, sinuate, white, discolored in drying. Spores narrow-piriform, tapering to the base, 2½ × 8–10.

"This we collected growing on pine at Temagami, Ontario, August, 1907. We referred it, from the description, with which it agrees exactly, to *Polyporus Weinmanni* of Europe, but we find the type of the latter plant at Kew is quite different, being *Polyporus mollis*. We think Professor Peck has col-

lected the same plant (cfr. Rep. 31) and also referred it to *Polyporus Weinmanni.*"

VARIIFORMIS. *Polyporus variiformis* Peck, Ann. Rep. N. Y. State Mus. 42: 26. 1889. This was referred by me to *Coriolellus serialis* (Fries) Murrill, but some authors claim that it is distinct. I must look at Peck's types again.

VARIUS. *Polyporus varius* (Pers.) Fries. *Polyporus calceolus* (Bull.) Murrill, Bull. Torrey Club 31: 41. 1904. Specimens collected in British Columbia by Macoun and at Clyde, New York, by O. F. Cook correspond very closely with specimens obtained by me in Sweden. In America, the species is rare and northern.

WASHINGTONENSIS. See *Coriolus washingtonensis* Murrill in Western Polypores, p. 4.

WEIRII. *Fomitiporia Weirii* Murrill, Mycologia 6: 93. *pl. 122.* 1914.

ZELLERI. *Polyporus Zelleri* Murrill, Western Polypores 13. 1915. Found at Seattle, Washington.

ZONATUS. *Coriolus zonatus* (Fries) Quél. When I examined numbers of fresh and dried Specimens of this common European species several years ago, I did not feel justified in admitting it to our flora. I have since seen specimens from Canada and New England which approach it very closely.

NEW YORK BOTANICAL GARDEN.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—VIII

TYÔZABURÔ TANAKA

PHYTOPHTHORA CARICA (Hara) Hori ex K. Sawada in Taiwan Hakubutsu Gakkwai Kwaihô (Journ. of Formosan Nat. Hist. Soc.) no. 26: 174–179. T. 5, xi, Nov. 1916. (Japanese.)

Kawakamia Carica Hara, Nôgyôkoku (Country of Agriculture) 9^3: 24–27. Mar. 1915; in Nippon Engei Zasshi (Journ. Hort. Soc., Japan) 30^4: 20–22. Apr. 1918.

Phytophthora Fici Hori, Byôchû-gai Zasshi (Journ. Plant Prot.) 2^{11}: 930–932. Nov. 1915.

Phytophthora Carica (Hara) Hori in Byôchû-gai Zasshi (Journ. Plant Prot.) 2^{12}: 1015–1017. Dec. 1915.

Phytophthora Carica Hara, K. Hara's Kwaju Byôgairon (A Discourse on Fruit Diseases) p. 431–436. Nov. 1916.

Phytophthora sp. Moeller in Bot. Mittheil. a. d. Tropen 9:3. 1901 (ex Sawada); Wilson in Mycologia 4^2: 77. 1914. (ex Sawada).

Aërial hyphae branching, thin-walled, continuous or septate at maturity, hyaline, 3–10 μ across; conidiophores solitary or fasciculate, much resembling aërial hyphae, simple or branching directly below the conidium, or irregularly forked, continuous or rarely septate, 36–480 μ long, seldom attaining to 1,000 μ, 3.5–4.5 μ across; conidia pyriform, oblong, ellipsoid, ovoid, or fusoid, bearing a distinct papilla 4–8 μ long, thin-walled, finely granulate, hyaline, 26–112 $\times$ 16–45 μ, wall contiguous to the end of conidiophores, often thickened, falling off at times with a part of conidiophore, germinating in water with germ tube or liberating zoöspores after 35 minutes; zoöspores several dozen from one conidia, ovoid or ellipsoid, ciliate at both ends, 12 $\times$ 8 μ, later transforming themselves into transparent, spherical resting-spores of 9–12 μ in diam., which also soon germinate with germ tube 3–4 μ across; germ tubes of conidia protrude usually from apical

papilla but occasionally from other part much branched, 4–10 μ across, often terminated by acrogenous secondary spore of the shape of conidia, otherwise a globe, which germinates with germ tube or produces zoöspores on germination; chlamydospores formed in the host tissue at ends of endogenous hyphae, seldom formed on conidiophores, globose, ochraceous, 15–49 μ, commonly 40–45 μ, wall at first thin, later thickened to measure 2 μ across; oögonia and oöspore yet unknown.

On *Ficus Carica,* causing white-rot (*Shiro-kusare* in Japanese) of fruits.

Type localities: Komaba, Tôkyô, College of Agriculture grounds, on "White Genoa," Sept. 1909, S. Kawagoe & K. Hara (ex Hara); Gumma-ken Agricultural Experiment Station grounds, on "Black California," Sept. 1915 (ex Hori).

Distribution: Taiwan (Formosa), also occurring on "Black California" (ex Sawada).

Hara states (in Kwaju Byôgairon p. 432) the disease commences in August or September. The fruit becomes darker in color and water-logged in appearance and is followed by immediate liquefaction and decay. The affection is at first limited to a small sunken area, but soon spreads over the entire fruit, developing in a few days a thick cottony cover of mycelium on its surface. A disagreeable odor usually accompanies the decay. The surface of rotten fruits remaining on the twig is white and longitudinally wrinkled in the dried condition.

Illustrations: Hara's Kwaju Byôgairon (p. 433) gives 8 woodcut figures illustrating the details of the fungus.

Notes: According to Hara's point of view, the genus *Kawakamia* ought to have its conidiophores unbranched or at least not branching immediately below the conidia (Hara '18 p. 22. See above). This distinction, however, is very uncertain and unreliable, as irregular branching of conidiophores is often observed in well established species of *Phytophthora, e. g. P. omnivora.* Sawada, dwelling upon *Kawakamia Cyperi* (Publication no. 102 of Agric. Exp. Stat., Taiwan, p. 10–18. June, 1916), rightly pointed out that the most important difference of *Kawakamia* from *Phytophthora* consists in having (1) well-developed haustoria and (2) its antheridia not tightly surrounding the oögonial

stalk, but simply attaching to the wall of oögonia at an arbitrary point, and (3) in its obligate parasitic nature. The conidium of *Kawakamia* is often reported to bear a collar cell at the basal end, but Sawada found this as a mere thickening of the wall, which is more prominent in *Kawakamia* than in *Phytophthora*.

CAPNODIUM TANAKAE Shirai and Hara sp. nov. in K. Hara's Kwaju Byôgairon (A discourse on fruit diseases) p. 239–242. T. 5, xi, Nov. 1916. (Japanese.)

Perithecia cylindric, simple or branched, with enlarged spherical apex containing asci, wall fungoid-parenchymatous in texture; asci clavate, tapering at both ends when fully matured, 6–8-spored, 30–45 × 10–12 μ; ascospores oblong or fusoid, not acutely pointed at both ends but rather blunt, 3-septate, fuscous, 10–15 × 4–5 μ.

Saprophytic on fruits of *Citrus grandis* (pummelo), forming irregular patches of thin felt of dirty blackish color, which only reflect the light slightly. In culture, hyphae and a form of conidia developed, which are not sufficiently worked out to prove whether they belong to a generation of this species or something else. Hyphae thus formed are at first whitish, then turn to the characteristic sooty color, plentiful, branching, septate, 3–5 μ across; upright hyphae resume a rôle of conidiophores, producing catenulate conidia at the end; conidia ellipsoid or ovoid, both ends rounded, smooth, continuous, 10–17 × 5–7 μ.

The crust is distinctly lighter in color than that of *Capnodium salicinum* and lacks the luster almost entirely. Microscopic characters are also distinct. No species resembling this has hitherto been described.

Illustrations: One woodcut and 1 black and white halftone figure showing the details of the fungus.

Note: The type material was collected by Tanaka at Kajiya, Yoshihama-mura, Kanagaa-ken, Nov. 7, 1909.

GLOEOSPORIUM FOLIICOLUM Nishida sp. nov. in T. Nishida's Shinpen Kankitsu no Byôgai to Yobôhô (A new discourse on citrus diseases and their protective measures) Tôkyô, p. 111–115. T. 3, xi, Nov. 1914. (Japanese).

Gloeosporium citricolum Hori in Kwaju (Fruit Tree) no. 123: 21. June, 1913; in Engei no Tomo (Friend of Horticulture) 9^7: 627. Jul. 1913; in S. Hori's Shokubutsu Byôgai Kôwa (Lectures on plant diseases) 2: 113–114. Nov. 1916. *not* Massee.

Acervuli plentifully formed on upper surface of fallen leaves, also appearing in less amount on lower surface, scattered or more or less loosely gregarious, first subepidermal, later erumpent and raised, light reddish-brown, about 120 μ in diam., also occurring on young twigs and on fruits; conidiophores densely fasciculate, cylindric, subacutely tapering toward the apex, 2–3-septate, branching, hyaline, 36–48 $\times$ 4–5 μ, terminated by conidia; conidia cylindric, not curved, rounded at the apex, bluntly pointed at the base, hyaline, sparingly nucleate, 14–20 $\times$ 4–6 μ, germinating from either end.

On *Citrus* spp. particularly on Navel orange, Satsuma (*Citrus nobilis* var. *Unshiu*), and Natsu-daidai (Japanese summer orange resembling grape-fruit).

Localities: Prefectures Wakayama, Hiroshima; Islands Kyûshû, Taiwan.

Spots first appear on leaves in spring and summer as cloud-like irregular patches of somewhat dark color, which are indefinitely margined from the healthy part. Such leaves soon lose their vigor and defoliation immediately follows. Minute pinkish pustules then appear plentifully on the surface of fallen leaves. New shoots and fresh tips of the twig are also attacked, causing immediate change of color to yellowish-brown and finally to black, resulting in the entire death of that portion. On fruit, brownish spots are commonly met with, which soon develop pinkish pustules on the surface as in the case of the leaf.

Illustrations: 1 photograph (halftone) of badly damaged Satsuma plant at Wakayama prefecture (in 1911), and 1 woodcut showing a diseased leaf, conidiospores and conidia (both in Nishida l. c.).

Notes: In above cited literature Hori insists on the similarity of this fungus to *Gloeosporium citricolum* Massee, though it seems rather distinct in having branched conidiophores. Hemmi recently pointed out the parasitic nature of this fungus in Sapporo Nôrin Gakkwaihô (Journ. Soc. Agric. & Forestry, Sap-

poro) 10^{46}: 239–282. Oct. 1918, while Sawada (in Taiwan Agr. Exp. Stat. Public. No. 100: 4. June 1916) and Hara (Discourse on fruit diseases p. 284. 1916) maintain their opinion that this is saprophytic. The disease is now widely spread all over Japan and Formosa causing annually somewhat notable damage to various kinds of Citrus, especially to Satsuma orange. Protective measures are also studied by local agricultural experiment stations, for instance Wakayama-ken prefectural station (*see* Progress Report for Fiscal Year Taishô 3, 1914, etc., etc.).

DACTYLARIA PANICI-PALUDOSI Sawada sp. nov. in Taiwan Hakubutso Gakkwai Kwaihô (Journ. of Formosan Nat. Hist. Soc.), no. 22: 78–80. T. 4, xii, Dec. 1915. (Japanese).

Foliicolous; spots at first orbicular, later forming fusiform areas of 5–23 × 2–4 mm., olivaceous-brown, then producing a gray or dark-colored, dusty substance which covers the lower surface, finally changing from the middle, into straw color; conidiophores fasciculate, simple or occasionally branched; curved near the apex, 1–3-septate, cinereous, 80–160 × 4–5 μ, bearing a few conidia, not more than 10; conidia oblong-ovoid to obclavate, obtuse at the apex, rounded or rostrate at the base, 2-septate, slightly constructed, hyaline or cinereous, 17–26 × 8.5–12 μ, average 22 × 10.2 μ, germinating in water in two hours, germ tube long, 2 μ in diam., never producing chlamydospores.

On living leaves of *Panicum paludosum.*

Type localities: Chônaihoshô, Taihoku-chô, Taiwan, Apr. 5 & Oct. 25, 1907, Suzuki; Aug. 13 & Nov. 16, 1908, Fujikuro; June 19, 1909, Sawada; Oct. 6, 1909, Fujikuro; May 16, 1910, Sawada; Sept. 23, 1910 & July 6, 1911, Fujikuro; Sept. 4, 1911, June 20, July 15, Aug. 7, 1914, & Nov. 21, 1915, Sawada: Kyûkô, Shinchiku-chô, Oct. 10, 1915, Sawada: Taichû, Taichû-chô, Oct. 11, 1913, Fujikuro; June 1, 1907, Suzuki: Tôseikaku, Taihoku-chô, June 3, 1907, Suzuki: Rinkiho, Kagi-chô, May 27, 1907, Suzuki: Kôshiken, Tainan-chô, Nov. 8, 1909, Sawada: Bokusekikaku, Kwarenkô-chô, May 12, 1909, & May 30, 1911, Sawada.

Notes: Differs from rice blast fungus in its short and broad conidia which usually have marked elongation of rostra at the base, and also producing no chlamydospore on germination. This fungus is unable to infect the rice plant by inoculation, just as rice

blast fungus does no injury to *Panicum paludosum*. Similar relation was also found true in case of the Dactylaria of *Panicum sanguinale*.

In a later article (Nôji Shikenjô Tokubetsu Hôkoku—Special Bull., Agr. Exp. Stat.—Taiwan, no. 16: 65–66. June 1917). Sawada revised the diagnosis in following points:

Young round spots measure 2–3 mm. in diam.; conidiophores slightly swollen near the base, bearing 1–10 conidia on alternately inflected apices, brownish-gray, decreasing in intensity toward the apex; conidia pyriform or elongated-pyriform, with collar cell of 1.7–2 μ diam., 17–28 $\times$ 8.5–12 μ average 22.5 $\times$ 10.2 μ, terminal cell 4–11 μ average 7.4 μ, central cell 5–8.5 μ average 7 μ, basal cell 6–10 μ, average 8.1 μ; diameter of germ tube 3–3.5 μ.

Two additional plates (black and white lithograph) illustrate conidiophores, conidia and the germination of conidia, and one woodcut figure (on p. 20) gives general appearance of an affected leaf.

DACTYLARIA LEERSIAE Sawada sp. nov. in Taiwan Hakubutsu Gakkwai Kwaihô (Journ. of Formosan Nat. Hist. Soc.), no. 27/28: 252–253. T. 5, xii, Dec. 1916. (Japanese.)

Foliicolous; spots usually orbicular, 2–3 mm. in diam., or nearly fusiform, 5 $\times$ 2 mm., straw-colored at center, brown on margin; conidiophores fasciculate or solitary, simple, 2–3-septate, a little swollen near the base, alternately inflected at the apex, brownish-gray at the lower part, gradually becoming lighter toward the apex, 48–88 $\times$ 4–5 μ; conidia short-conic to elongate-conic, 2-septate, not constricted, rounded at the base which ends with a collar cell of 1.2–1.8 μ in diam., hyaline, 20–35 $\times$ 7–10 μ, average 27 $\times$ 8.6 μ, apical cell 6–13 μ, average 8.7 μ, central cell 7–12 μ, average 8.2 μ, basal cell 7–12 μ, average 9 μ, basal cell not sinuate toward the papilla; germ tubes 3–4 μ diam., septate, bearing acrogenous chlamydospores, chlamydospores cinereous, 9.5–12 $\times$ 9–10 μ.

On living leaves of *Leersia hexandra*.

Type localities: Chônaihoshô, Taihoku-chô, Taiwan, July 3, 1914, and Apr. 15, Dec. 4, 1915, and Aug. 18, 1916, Sawada; Shirin, Taihoku-chô, Sept. 23, 1916, Sawada.

Notes: Almost similar to rice blast fungus, only differing in (1) smaller collar cells which are attached to non-attenuated

base of conidia, (2) much larger chlamydospores, (3) less richly formed aërial hyphae in culture, and (4) when observed in culture distinctly more slender conidia with narrow basal cells. Hyphae of this species do not develop on bouillon-agar prepared with the extract of *Panicum paludosum,* while the rice blast fungus does very well on that medium. Inoculation failed on rice plant, just as the rice blast fungus has not been successfully transferred to *Leersia hexandra.*

Redescribing this species in Nôji Shikenjô Tokubetsu Hôkoku (Spec. Bull., Agr. Exp. Stat.), Taiwan, no. 16: 65 (June 1917), Sawada states that the spots are at first orbicular, 1–3 mm. in diam., then becoming angular, finally resuming fusiform shape. Illustration in black and white lithograph shows conidiophores, conidia, and germination of conidia in detail. Leaf spots are also shown in a text figure appearing on p. 21.

DACTYLARIA COSTI Sawada sp. nov. in Nôji Shikenjô Tokubetsu Hôkoku (Special Bull., Agr. Exp. Stat.), Taiwan, no. 16: 24–25, 66–67. T. 6, vi. June 1917. (Japanese.)

Spots usually occurring on leaves; small, orbicular, never becoming fusiform, 1–1.5 mm. in diam.; conidiophores fasciculate or solitary, simple, generally 2–3-septate, slightly swollen near the base, brownish-gray, becoming lighter toward the apex; conidia elongate-pyriform to clavate-fusoid, 2-septate, not constricted, both ends obtuse, often rounded at the base, with small collar cell of 1.5–1.7 μ in diam., hyaline, 20–30 $\times$ 7.5–10 μ average 24 $\times$ 8.6 μ, apical cell 8.5–12 μ, average 10.6 μ, other cells practically in equal length, basal cell not attenuated toward the papilla.

On living leaves of *Costus speciosus.*

Type locality: Chûho, Kagi-chô, Taiwan, Oct. 15, 1913, T. Kawakami.

Illustrations: One text figure (on p. 24) showing leaf spots, and one black and white lithographic plate giving detailed figures of conidia.

Note: In an elaborate article of Y. Nishikado in Ohara Nôgyô Kenkyûsho Hôkoku (Report of the Ohara Agricultural Institute) 1^2: 171–218, Dec. 1917, two more species of blast fungi found on *Setaria* spp. and on *Zingiber* spp. are described which are determined as spp. nov., *Piricularia Setariae* and *P. Zingi-*

beri respectively. It seems more likely that all these blast fungi belong to *Piricularia* rather than *Dactylaria,* as they are provided with solitary conidia which are produced at the end of more or less elongate, spike-like conidiophores, which can never be termed capitate, as was pointed out by Nishikado (l. c., p. 210). S. Ito, therefore, suggested the new combination of Sawada's three new species as *Piricularia Panicipaludosi, Piricularia Leersiae,* and *Piricularia Costi* (Bot. Mag., Tôkyö 32^{382}: 307–308. Japanese. Oct. 1918).

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

THE ALTERNATE STAGE OF PUCCINIASTRUM HYDRANGEAE[1]

J. F. Adams

Arthur (1) reports the genus *Pucciniastrum* as represented by nine species in *North American Flora*. At that time (1907) the aecial stage for none of the species was known in this country, and for only one of them in Europe. Since the publication of that part of the Flora two species have been connected with a *Peridermium* stage by American investigators, and one other, *P. sparsum* (Wint.) Ed. Fischer (3), by a European investigator.

In the summer of 1911 Fraser (4) was first to report successful inoculations in this country between the aecial stage of *Pucciniastrum pustulatum* (Pers.) Diet. on *Abies balsamea* and the telial stage on *Epilobium angustifolium*. In 1916 Weir and Hubert (6) reported successful inoculations of *Abies lasiocarpa* with telia of *Pucciniastrum pustulatum*. The aecial relationship had previously been established abroad by inoculations by Bubák, Fischer, Klebahn and Tubeuf (5).

Clinton (2) in 1910 was the first to report successful inoculations with the aecia of *Peridermium Peckii* Thüm., and established its relation with *Pucciniastrum Myrtilli*. Fraser in 1910 established the relationship between *Peridermium Peckii* and *Pucciniastrum minimum* (Schw.) Arth. Prof. C. R. Orton and the writer in 1914 successfully cultured *Peridermium Peckii* on *Azalea nudiflora, Vaccinium angustifolium* and *Gaylussacia* sp. These results indicate the relationship between these two forms of *Pucciniastrum* on Ericaceous hosts and are such that they may be identical.

The writer collected material of *Pucciniastrum Hydrangeae* (B. & C.) Arth. on *Hydrangea arborescens* L. at Bear Run, Lamar Gap, Clinton County, Pa., July 28, 1917, which is the first

[1] Contribution from the Department of Botany, Pennsylvania State College, No. 19.

collection reported for Pennsylvania. The leaves were heavily infected. Along a path for a distance of one fourth of a mile, the Hydrangeas and Hemlocks were quite numerous. The Hemlocks were infected with a *Peridermium,* which resembled *P. Peckii*. Additional material of the *Peridermium* stage was collected June 24, 1919. At this time the infection was just appearing on the first leaves of the new growth. Inoculations with this material was made the following morning in the greenhouse on *Hydrangea arborescens grandiflora* and *H. hortensis*. Two other species growing in the botanical garden were inoculated. *H. petiolaris* and *H. paniculata grandiflora,* as well as a species of *Vaccinium*. On July 7, 1919, mature uredinia were observed on the leaves of *H. arborescens grandiflora,* a sterile, cultivated form of the wild *Hydrangea arborescens* L. The results on the other plants were negative. A visit was made to Bear Run, July 17, 1919, when mature uredinia were found developing on the leaves of *Hydrangea arborescens*. An examination of the *Vaccinium* spp., and of *Agrimonia gryposepala,* in the vicinity failed to reveal any infection.

Compared with *Peridermium Peckii* this *Peridermium* shows a close similarity. The pycnia are not so large, and do not extend between the walls of the epidermal cells so deeply. Aecia when fresh are deep orange in color, and more elongated. The aeciospores are more uniformly ellipsoid, and more finely verrucose, than those of *P. Peckii*. On the basis of cultural relations a new combination is made. The morphological characters are such as to identify this form as a new *Peridermium* and the following new name is proposed to represent this in the form genus *Peridermium* with pycnia and aecia described as follows.

Peridermium Hydrangeae (Berk. & Curt.) comb. nov.

O. Pycnia amphigenous, usually hypophyllous, subcuticular, abundant, inconspicuous, flattened, 74–112 μ wide, 80–145 μ broad, 19–32 μ high, extending slightly between the lateral walls of the epidermis, frequently confluent.

I. Aecia hypophyllous, in two rows, cylindric, deep orange when fresh, 160–220 μ in diameter, 1–1.5 mm. high, dehiscent at apex, also sometimes by side slits; peridium colorless, with cells slightly overlapping, the outer walls thin, the inner walls finely

verrucose; aeciospores broadly ellipsoid, 10–19 by 19–32 μ; wall colorless, with an elongate spot smooth on one side, the remainder finely verrucose, thin, from 1–1.5 μ thick on smooth side to 3 μ on opposite side.

On *Tsuga canadensis* (L.) Carr. (*Pinaceae*), Bear Run, Lamar Gap, Clinton County, Pennsylvania, July 17, 1919, *J. F. Adams.* Specimens have been deposited in the herbaria of the New York Botanical Garden, Botanical Department of the Pennsylvania State College, and the Arthur Herbarium at Purdue University.

STATE COLLEGE, PA.

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2. **Clinton, G. P.** Notes on Plant Diseases of Connecticut, Part X of the Biennial Report of 1909–1910, 713–738.
3. **Fischer, Ed.** Cent. fur Bakt. 46: 333, 1916.
4. **Fraser, W. P.** Cultures of Heteroecious Rusts Mycologia 4: 4, 175–193, July, 1912.
5. **Sydow, P. & H.** *Monographia Uredinearum* 3: 443, 1914.
6. **Weir, J. R. and Hubert, E. E.** A successful inoculation of *Abies lasiocarpa* with *Pucciniastrum pustulatum.* Phytopathology 6: 373, 1916.

NOTES AND BRIEF ARTICLES

[Unsigned notes are by the editor]

Mr. W. S. Fields, formerly with the Bureau of Plant Industry in Mississippi as extension pathologist, has been appointed pathological inspector for the Federal Horticultural Board, and is at Washington, D. C.

Mr. G. F. Gravatt has returned to his position as assistant pathologist in the Bureau of Plant Industry, having recently been discharged from the Navy. He will work on the white pine blister rust and the chestnut bark disease.

Mr. A. H. Gilbert has entered the joint employ of the Vermont State Department of Agriculture and the Agricultural Experiment Station, with headquarters at Burlington. Until lately he held the position of extension pathologist for the Bureau of Plant Industry in Vermont.

Mr. A. C. Foster, formerly with the North Carolina Agricultural College as assistant in plant pathology, has been released from military service and has accepted a position at the Wisconsin Agricultural Experiment Station, Madison, Wisconsin, to investigate cucumber diseases.

Mr. W. A. McCubbin, formerly in charge of the Dominion Laboratory of Plant Pathology at St. Catherines, Ontario, has become deputy director of plant industry for the Pennsylvania Department of Agriculture at Harrisburg. He is located temporarily at Freeland, where he is assisting in the administration of quarantine regulations for restricting the spread of the potato wart disease.

A disease of Carolina poplar seedlings due to *Pleococcum populinum* is discussed by A. Bertin in *Vie Agr. et Rurale*, p. 292. 1918. The fungus enters readily through wounds, and may be controlled by spraying the young trees with Bordeaux mixture.

Citrus canker is reported by E. M. Doidge to occur in several places in South Africa, having been introduced from Japan on *Citrus trifoliata* stock. This most serious of citrus diseases has also appeared in Australia, the Philippines, and the Southern United States.

A popular sketch of the life and work of Elam Bartholomew appeared in the *American Magazine* for November, 1919, contributed by E. F. Tinker. A good photograph of Mr. Bartholomew, as he now appears at the age of sixty-six, accompanies the article.

The common field mushroom, *Agaricus campester*, was notably scarce last season in the vicinity of New York, doubtless owing to the unusually rainy weather. Did the mycelium fail to develop or did it develop so copiously that it failed to fruit? Were light and heat major or minor factors? It must be remembered that fungous mycelium requires oxygen just as any other growing plant.

A specimen of the rare *Anthurus borealis* Burt was brought in by Mr. Boynton on October 31, 1919, from the Gladiolus bed in the Garden grounds, where the students of the Garden School discovered it. This interesting stinkhorn is divided at the top into six narrow, hollow arms. It was first brought to our attention in May, 1911, by Dr. F. M. Bauer, who found it growing in quantity in mushroom beds on Blackwell's Island. So far as known, Mr. Boynton's specimen is the first ever collected within the New York Botanical Garden.

Gum formation in its relation to Cankers is discussed by Higgins in Bulletin 127 of the Georgia Experiment Station. The

author carried on a series of experiments in the artificial production of gummosis under partially controlled conditions and found that gum formation, although affected to some extent by variations in temperature, moisture, etc., is not dependent upon or always associated with growth activity. This behavior, together with the fact that a pectin-dissolving enzym is always found in freshly exuded gum, is held to indicate that gum formation is brought about by enzym activity.

A parasite of the tree fern, *Cyathea arborea,* causing black spots on the fronds, is described and handsomely illustrated by Stevens and Dalbey in *The Botanical Gazette* for September, 1919, under the name *Griggsia cyathea.* The genus as well as the species is new and belongs in the Dothidiales.

A long and abundantly illustrated article on the development of *Pluteus admirabilis* and *Tubaria furfuracea,* by Leva B. Walker, appeared in *The Botanical Gazette* for July, 1919. The material was collected at Ithaca and in the Adirondacks, and the investigation conducted at Cornell during the summers of 1916 and 1917 under the direction of Professor Atkinson.

Dr. E. P. Meinecke, of the Bureau of Forest Pathology in San Francisco, visited the Garden on December 22 to consult the mycological herbarium. He was especially interested in a specimen of *Peridermium* in the Ellis Collection, which was sent to Ellis many years ago from California by Harkness.

The influence of soil environment on root rot of tobacco caused by *Thielavia basicola* is discussed by Johnson and Hartman in the second number of the *Journal of Agricultural Research* for 1919. Saturated soils are favorable to the disease, but its occurrence is determined primarily by the soil temperature, the optimum ranging from 17 to 23° C. Acid fertilizers will not reduce infection, and fertilizers applied to heavily infested soils are largely wasted.

An excellent sketch of the life and work of Dr. Howard A. Kelly, of Baltimore, contributed by Dr. Thomas S. Cullen, with a bibliography of 485 titles prepared by Miss M. W. Blogg, appeared in *The Johns Hopkins Hospital Bulletin* for October, 1919. As Dr. Kelly is only about sixty and appears very much younger, we may expect many additions to his extended bibliography before it is ready for final binding.

An interesting and helpful bulletin by Jones, Miller, and Bailey on frost necrosis of potato tubers appeared in October, 1919, from the Wisconsin Agricultural Experiment Station. This injury is due not to solid freezing, after which the tubers collapse upon thawing, but to partial freezing that does not affect the tubers externally. When cut open, however, characteristic discolorations appear, which might easily be attributed by the uninitiated to the attack of some fungus.

Those interested in mosaic diseases, which are quite in the public eye at this time, will welcome an article by Schultz and others in the *Journal of Agricultural Research* for September 15, 1919, dealing with potato mosaic. The article was read in manuscript at the conference of potato pathologists on Long Island last June. There are several illustrations, some of which are in natural colors.

"The Farmers' Dictionary and Household Cyclopedia," by the late Dr. George Thomas Surface, formerly on the Yale University Staff, has just been published in a limited edition by the author's father, Rev. F. D. Surface, of Blacksburg, Virginia. It is a handbook of 730 pages with up-to-date information on practical farming and domestic science arranged in alphabetical order for the use of farmers and their wives. As the facts are mostly taken from agricultural publications, a copy of this work would no doubt prove very valuable and handy in any agricultural experiment station. It is splendidly written, well printed, and costs little.

A fresh young specimen of *Ganoderma sulcatum* Murrill was collected by Dr. and Mrs. Pennell, November 22, 1919, on a trunk of *Sabal Palmetto* on the Isle of Palms, Charleston County, South Carolina. Several large specimens were seen at the time, similar to one brought in from the same locality in February, 1916, by Dr. Small. This species was described in 1902 from specimens collected in Florida by Mr. C. G. Lloyd. It seems to be confined to the palmetto and is known only from Florida, Georgia, and South Carolina. Mr. W. H. Long found it several times in Florida. The single Georgia collection was made by Mr. R. M. Harper in 1903 near Thalmann, in Glynn County.

The nematode disease of wheat in Virginia is treated by F. D. Fromme in Bulletin 222 of the Virginia Agricultural Experiment Station under date of August, 1919. This disease is already widespread in the state, being known from 33 counties. Its presence may be recognized by the wrinkling and distortion of the leaves of the young wheat plants, by the abnormal appearance of the heads, and by the occurrence of hard, brown galls in the heads in place of the grains of wheat. It may be prevented by the use of clean seed and crop rotation.

ERGOT ON PASPALUM

Last fall, especially during the latter part of October, ergoty *Paspalum* was extremely common in the vicinity of Fayetteville, Arkansas. Specimens were also received from other localities in the state. The grayish-white sclerotia corresponded to the descriptions of these bodies on this host genus. However, it was not ascertained whether the fungus was *Claviceps Paspali* Stevens & Hall or *C. Rolfsii* Stevens & Hall. Dr. F. L. Stevens, in correspondence, writes that it is necessary to germinate the sclerotia in order to determine the species of *Claviceps* involved; apparently the sclerotia of the two species are very similar and the differences between the two species are only to be observed in the fruiting heads which bear the asci.

Stevens and Hall (Bot. Gaz. **50**: 460. 1910) list two species of *Paspalum* as hosts for these fungi, *P. laeve* and *P. dilatatum*. Brown and Ranck (Miss. Agr. Exp. Sta. Bul. 6, 1915) added *P. distichum*. *P. laeve* was very commonly infected in this region and also *Paspalum floridanum* Michx., a host species not previously reported, was found to bear similar sclerotia. It is interesting to note that attacked spikelets fall with the pedicels attached to them, in contrast to the fall of normal spikelets in which the pedicels remain attached to the rachis.

H. R. ROSEN.

FUNGI FROM HEDGCOCK

A number of boxes of polypores collected by Hedgcock, Long, Humphrey, Weir, Hartley, and others, in various parts of the United States were sent in some time ago from the Division of Forest Pathology for identification and verification, and duplicates were added to our herbarium. The collection contained many interesting specimens. A partial report follows:

Fomes putearius Weir from the Northwest, on *Abies, Picea, Pinus,* etc. Compare *Fomes spongiosus* of Europe.

Funalia stuppea from various localities, chiefly on *Populus*.

Hapalopilus gilvus from California, on oak.

Hapalopilus licnoides from Georgia, on bald cypress. This may be what was recently reported as *Fomes torulosus*.

Inonotus dryadeus from Washington, on *Tsuga heterophylla*. This was collected several times by Humphrey. I have it also from Oregon on this host and on *Abies grandis*. It is difficult to believe until one has seen the specimens that this oak-loving species occurs on conifers.

Inonotus dryophilus from Arizona, on *Populus*.

Pyropolyporus Bakeri from Texas, on oak.

Spongipellis borealis from Vermont, on sugar maple.

Spongipellis fragilis from Pike's Peak, Colorado, 11,000 ft. elevation, on *Pinus flexilis*.

Trametes Morganii? of Lloyd from Maryland, on *Liriodendron*.

Trametes robiniophila? from Texas, on oak. The specimen is old and discolored.

Tyromyces guttulatus from Idaho, on *Pinus Murrayana*.

W. A. MURRILL.

COLLECTING FUNGI AT YAMA FARMS

Yama Farms is a vast tract of virgin land lying twenty miles due west of Poughkeepsie among the foothills of the Catskill Mountains. It is a beautiful natural asylum for wild life of all kinds and will doubtless remain so for many years to come. Authors, musicians, artists, naturalists, and other lovers of nature from all parts of the country find their way to this quiet resting-place at every season of the year and return to their homes greatly refreshed and more deeply impressed with the abundance and charm of nature's offerings.

On November 7, 1919, I went up to Yama in company with Mr. H. I. Miller and the following day we covered about one hundred miles by motor, visiting the most inviting localities and collecting all the larger fungi to be found. Beginning at Jenny Brook, famous for its trout, we worked southward past Ellenville and into the hills to the west before noon. In the afternoon, we drove twenty-eight miles in a northwesterly direction up the valley of Lackawack Creek and turned northward through a virgin forest lying in the edge of Sullivan County. Here among the hemlocks, yellow birch, beech, and other characteristic Catskill and Adirondack trees we found a rich collecting ground and obtained many interesting specimens. At the height of the collecting season, this would be a veritable paradise for mycologists.

The trip was not without interest, also, to the botanist of less specialized tastes; for mosses, ferns, rhododendron, and kalmia covered the rocks and banks everywhere, while climbing bittersweet and holly brightened the swamps and hedgerows with their orange and scarlet berries.

The result of our day's collecting can hardly be given in a brief article. Mr. Miller and I went through the specimens and

named and listed them systematically, recording nearly a hundred distinct species. Of course, most of the fleshy forms had been killed by the heavy frosts, but we obtained enough of these for luncheon next day, when twenty-three guests were served from a dish consisting chiefly of *Hypholoma perplexum, Pleurotus ostreatus, Pleurotus serotinus,* and *Collybia velutipes.*

The two species of *Pleurotus* were found mostly on sugar maple trees along the roads, while the *Collybia* grew on fence posts and stumps. *Pleurotus serotinus* can not be recommended, owing to its slimy character, but we were compelled to use it as a "filler."

Among discoveries of special scientific interest, I might mention *Spongipellis fragilis* and *Fomitiporia tsugina,* on hemlock; *Polyporus admirabilis* and *Coriolellus malicola,* on apple; *Daedalea quercina,* on butternut; *Fomes ungulatus,* on a chestnut stump; and *Pyropolyporus igniarius* and *Spongipellis galactinus,* abundant in apple orchards. Two or three new species were probably discovered, among them a beautiful clustered *Stropharia.*

The affinities of the fungi found are with those of the Catskill region, which was visited by the author in August, 1916. For a list of the species collected at that time in the vicinity of Arkville, see *Mycologia* for November, 1916.

I am deeply indebted to Mr. Seaman, Mr. Miller, and Mrs. Sarre for this opportunity of visiting Yama Farms and enjoying its hospitality and natural treasures.

W. A. MURRILL.

MEETING OF THE CANADIAN BRANCH OF THE AMERICAN PHYTOPATHOLOGICAL SOCIETY

The first annual meeting of the Canadian Branch of the American Phytopathological Society was held at the Ontario Agricultural College, Guelph, Ontario, December 11th and 12th.

Canadian Phytopathologists were well represented at this meeting. Among those taking active part in the proceedings were: Dr. A. H. R. Buller, University of Manitoba; Dr. J. H. Faull, Toronto University; Mr. P. A. Murphy, Dominion Laboratory of

Plant Pathology, Charlottetown, P. E. I.; Mr. W. H. Rankin, St. Catharines; Mr. W. P. Fraser, Saskatoon, Sask.; R. J. Blair, Forest Products Laboratories, Montreal; Mr. F. L. Drayton, Central Experimental Farm, Ottawa; Professor L. Caesar, Professor J. E. Howitt and Dr. R. E. Stone, Ontario Agricultural College.

The President, Professor J. E. Howitt, in his address dealt with what should be the aims of this Society. These, briefly summarized, are as follows:

First—To provide adequate facilities for the training of research men in Plant Pathology in Canada.

Second—To make provision for the publication in Canada of the results of scientific investigations in Plant Pathology not of interest to the general public.

Third—To make available to the general public the practical application of results obtained from scientific research in Plant Pathology.

Fourth—The unification of recommendations made by the various pathologists regarding the control of the more common diseases.

Fifth—The carrying out of a plant disease survey to secure information concerning the financial losses caused by disease to Agriculture and Forestry and the distribution of plant diseases throughout Canada.

Sixth—The adoption of a standard of qualifications required of men entering the field of Plant Pathology in Canada.

Seventh—The appointment of an advisory board to confer with the Federal and Provincial authorities regarding plant quarantine and other restrictive legislation.

Eighth—The maintaining of a bibliography of Canadian Plant Pathology.

Dr. E. C. Stakman of the University of Minnesota was a guest of the Canadian Branch and dealt with the Cereal Rust problems in the United States and Canada.

The papers on the following programs were given at this meeting:

PROGRAM

President's address	J. E. Howitt
Health and Disease in Plants	F. L. Drayton
Decay in the Timber of Pulp and Paper Mill Roofs... (Illustrated with lantern slides.)	R. J. Blair
Butt Rots of the Balsam Fir in Quebec Province.....	W. H. Rankin
Leaf Blight of the White Pine	J. H. Faull
Pseudorhiza of Certain Saprophytic and Parasitic Agaricinae. (Illustrated.)	A. H. R. Buller

EVENING PROGRAM

Address of Welcome	President G. C. Creelman
Address	Dr. E. C. Stakman
Education of Plant Pathologists. Discussion led by	Dr. J. H. Faull

PROGRAM

Witches'-Broom of the Canada Balsam and the alternate hosts of the causal organism..............	R. E. Stone
Some comparative observations upon the shape of Basidia and Method of spore Discharge in the Uredineae and Hymenomycetes. (Illustrated with models and lantern slides.)................	A. H. R. Buller
Smut of Western Rye Grass	W. P. Fraser
Address	E. C. Stakman
Some observations made in inspecting for Leaf Roll and Mosaic of Potatoes	J. E. Howitt
New or Little-known diseases of potatoes which cause the running out of seed.......................	P. A. Murphy
Breeding Beans for Disease Resistance............	G. P. McRostie
Combination sprays for Apple and Potato. (By title.).	G. E. Sanders
Some Data on Peach Yellows and Little Peach......	L. Caesar
Fungi New to Ontario............................	A. W. McCallum
Some Fungi and Plant Diseases comparatively new to Ontario	R. E. Stone and J. E. Howitt

The following officers were elected for 1920: President, Dr. A. H. R. Buller; Vice-President, Dr. J. H. Faull; Secretary-Treasurer, Dr. R. E. Stone.

Additional Members of the Council: Professor J. E. Howitt and Mr. F. L. Drayton.

R. E. STONE

TRAMETES SERPENS

This species was first described by Fries in 1818 under *Polyporus,* then transferred to *Daedalea* in 1821, and finally to *Trametes* in 1874. In the "Systema," the following description of it appears:

"D. *serpens,* effusa, suberoso-tenuis, confluens, ligneo-pallens, margine villoso, poris magnis inaequalibus.

"Color D. quercinae. Margo tenuis, pubescens. Sinulorum dissepimenta crassa. Inter corticis rimas per lineas elongatas seriatas & confluentes serpit. *Ad truncos Quercus mortuos, sed non prostratos!*"

This description was well supplemented by Fries in his Icon. *pl. 192, f. 3,* which shows the characteristic, large, unequal pores, over 1 mm. in diameter. The spores are said to be ovoid, hyaline, $14 \times 6\,\mu$, and no mention is made of setae. I have examined specimens in the various European herbaria and have in the collection here an excellent specimen from Bristol, England, sent by Massee. The conclusion I reached at Upsala in 1906 was: "All the *Trametes serpens* found in Europe is entirely different from what goes by this name in America. The pores are larger and are all different."

When collecting in Cuba, I found the American plant very abundant, and it is surprising that it does not appear prominently in the list of Cuban fungi collected by Wright. The only description in this list that seems to fit it is of *Polyporus excurrens* (*Wright 391*), collected once in April on the underside of old logs and described by Berkeley and Curtis as

"Totus resupinatus, immarginatus, lignicolor; poris mediis subangulatis demum sinuosis, dissepimentis crassiusculis obtusis acie subtiliter tomentosis. Pores 1/60 inch in diameter."

The type of this species was not found by me at Kew, and the brief description alone would hardly justify a positive statement regarding its identity. I have asked Miss Wakefield to look up the type.

In the "Ellis Collection," many specimens are found collected in Florida, where this species seems to be unusually abundant on various kinds of dead deciduous wood. These specimens are

sometimes called *Trametes serpens* Fries and sometimes *Polyporus Stephensii* Berk. & Br., an identical European species described from plants collected by Stephens on privet twigs near Bristol, England, in 1847.

The American plant ranges northward into South Carolina and southward to Brazil, showing considerable variation in the size, shape, and obliquity of its tubes, which are always smaller, however, and otherwise distinct from those of the true European *T. serpens*. The following collections I have examined will indicate the distribution:

Ellis & Ev. N. Am. Fungi *1707;* Rav. Fungi Am. *112;* Rav. Fungi Car. 4: *7;* South Carolina, *Ravenel;* Louisiana, *Langlois 1612, 2512, 2559;* Florida, *Calkins 47, 51, 60, 68, 116, 130, Lloyd 2129, Ravenel, Rolfs 7, Mrs. Russell, Small & Mosier 5407;* Cuba, *Earle 1591, Earle & Murrill 117, 124, 144, 148, 152, 200, 305, 321, 459, 475, 476;* Jamaica, *Earle 469, Murrill & Harris 1020;* Porto Rico, *Stevens 8988;* St. Thomas, *Raunkiaer 180;* Mexico, *Murrill 642, Smith 205;* Colombia, *Baker;* Bolivia, *Bang 2310;* Brazil, *Möller.*

There has come to me recently from the Philippine Islands a specimen named *Elmeriana setulosa* (P. Henn.) Bres., which seems to match very closely our American plant. Another Philippine specimen named *Poria straminea* Bres. does not appear to be distinct from *E. setulosa* except in the obliquity of its tubes. A fine Philippine collection made by Mr. Williams, however, differs from both the above in its much larger and more shallow pores, suggesting in their size the plant with which we began this discussion, but evidently much more American than European in its affinities.

W. A. MURRILL.

THE GENUS PORIA

The name *Poria* was used generically by Dr. John Hill in his "History of Plants," published in 1751, to include certain large pileate species such as *Fomes Laricis* and *Fistulina hepatica*. On page 28, the genus was described as follows:

> "Poria is a genus of Fungus's growing horizontally, but having its underside not formed into lamellae, but full of little holes or pores . . ."

Adanson (Fam. 2: 10. 1763) based his genus *Poria* on Mich. *pl. 61. f. 2.* 1729, a polynomial and as yet undetermined species, citing *A. porosum* Brown in support of his use of the name. His treatment was similar to that of Hill, since it included only pileate forms.

This historical use of *Poria* was followed until the time of Persoon, who properly established the genus and included in it resupinate species only, without reference to previous usage.

PORIA Pers. Neues Mag. Bot. 1: 109. 1794

Physisporus Chev. Fl. Par. 1: 261. 1826.

Hymenophore resupinate, epixylous, perennial, inseparable, rigid; context thin, white; tubes white, becoming stratified after a year or more; spores hyaline.

Type species, *Poria medullapanis* (Jacq.) Pers.

This genus was founded upon three species, *P. medullapanis, P. salicina,* and *P. fimbriata,* the last two of which are generically distinct from the first. *Physisporus* was based on nine species, the first accompanied by the citation of a figure being *P. medullapanis.*

PORIA MEDULLAPANIS (Jacq.) Pers. Neues Mag. Bot. 1: 109. 1794

Boletus medullapanis Jacq. Misc. Austr. 141. *pl. 11.* 1778.
Polyporus pulchellus Schw. Trans. Amer. Phil. Soc. 4: 158. 1832.
Polyporus dryinus Berk. & Cooke; Berk. & Curt., Grevillea 6: 130. 1878.
Poria tomento-cincta Berk. & Rav.; Cooke, Grevillea 15: 26. 1886.
Poria holoxantha Berk. & Cooke; Cooke, Grevillea 15; 26. 1886.

Jacquin gave a fairly good and complete description of the plant, with a poor figure. It is no wonder that Fries could not interpret this description, since he had probably never seen the plant. I have seen only one specimen of it from Sweden. Persoon, on the other hand, had a considerable number of specimens in his herbarium and it is to him that we must look for the true idea of the species.

Bresadola saw Persoon's specimens and knew the plant well in its various stages, as found abundantly in central and southern Europe on dead wood of oak, aspen, ash, cherry, olive, etc. He describes it as follows:

"Species haec, omnium comunissima in Europa media, videtur in Suecia deesse, nam neque in Herbario Friesii, neque in collectione Romell inveni. Perennans est, stratosa, poris angulatis, mediis, integris, saepe obliquis; sporis obovatis, uno apice truncatis, hyalinis, $5–6.5 \times 5.5–5\,\mu$, una alterave etiam subangulato-polygonali; hyphis subhymenialibus, $1.5–2\,\mu$."

According to Schroeter, the spores are $4.5 \times 3–4\,\mu$ and the species occurs on both deciduous and coniferous wood the whole year through. I have not seen specimens taken from coniferous wood either in this country or in Europe.

In America, there has been considerable confusion regarding this species. Schweinitz called it *P. obducens* because it was stratose; Morgan associated it with *P. xantholoma* because it was often yellow; and Ellis named his specimens *P. obducens, P. vulgaris, P. pulchella,* etc., according to the vagaries of Cooke and his other advisers.

And there is more than one good reason for this confusion. When I compared our American specimens with those of Persoon, I could hardly believe they were the same species; and it required a close study of hundreds of specimens from various regions and different hosts to connect up the series satisfactorily. This is often the case, however, with species so widely distributed, since there is every reason for them to vary widely.

I have on the table before me several specimens from Bresadola. The thin forms of one or two years' growth agree perfectly with the types of *P. pulchella* and other large-pored forms found especially on oak in America. A fine collection from Tolland, Colorado, is eminently typical of the European plant. The older, stratose specimens from Bresadola, however, agree with the older specimens found abundantly in New York and New Jersey on fallen branches of various kinds, which in their early stages appear quite distinct from the European forms that I have seen. Morgan describes this young stage as follows:

"P. xantholoma, Schw. Widely effused, closely adnate, even, smooth, dry; the border rather broad, velvety, yellowish. Pores minute, unequal, subrotund, obtuse, pale yellowish.

"Common in woods. Effused often to the extent of many inches or even several feet on the underside of sticks or smaller branches lying somewhat up from the ground and keeping dry. The border is sometimes 'elegantly luteous' and therefore of a deeper yellow than the pores but this is not always the case. The pores at first are pale, maturing into a rich cream-color; they are mostly roundish but vary to oblong and subsinuous; the dissepiments are thick and obtuse; they average .16 mm. in diameter."

A more complete description accompanies a collection made by Overholts on elm logs in Ohio in 1911, which includes both young and old stages:

"Effused, irregular, firm and rigid, perennial, 6–8 mm. thick; margin thin, narrow, adnate, tomentose; hymenium plane or convex, even, white, pallid or yellowish in old specimens, with a slight silky sheen on some specimens; mouths circular, thick-walled, entire; tubes 1–2 mm. long each season, white within; spores elliptical, smooth, hyaline, $4.5–5.5 \times 2.7–4.5\,\mu$."

Allowance must always be made for weathering, exposure to light, obliquity of tubes, condition and character of substratum, etc. If one finds a conspicuous species of Poria on an old, exposed, decorticated locust or chestnut post, it is pretty apt to be this species, which is by no means choice but is very common and widely distributed in America on dead wood of oak, chestnut, black locust, poplar, beech, witch hazel, dogwood, sassafras, maple, mulberry, elm, tulip, ash, and probably other deciduous trees. *P. albo-incarnatus* Pat. & Gaill., from Venezuela, and *P. vitellinulus* P. Karst., from Finland on alder, do not appear to be distinct. Among the great number of collections examined, the following will serve to indicate its distribution in this country.

Ellis & Ev. N. Am. Fungi *503, 3409;* Ellis & Ev. Fungi Columb. *402;* Rav. Fungi Car. 3: *12;* Canada, *Dearness, Macoun 151;* Rocky Mountains, *Macoun 532;* Maine, *Murrill 1787;* New Hampshire, *P. Wilson;* Connecticut, *Underwood;* New York, *Atkinson* (Cornell Univ. Herb. 8254, 8279), *Brown 135, Dodge & Seaver, Fairman, Livingston & Crane, Murrill 2709, Underwood 308, P. Wilson;* New Jersey, *Ellis 3844, P. Wilson;* Pennsylvania, *Banker, Haines & Everhart, Jackson 25, Murrill 1020, 1045, 1070,*

Sumstine 3, 13, 30, 43, 45, 57; Delaware, *Commons 2294, 2343;* District of Columbia, *Sheldon 73;* Virginia, *Long, Murrill 217, 240, 353;* West Virginia, *Hartley 49, Nuttall;* Ohio, *Fink 54, James, Lloyd 2794, 3135, Morgan 88, 601, Overholts 172, 216;* Kentucky, *McFarland 168;* Illinois, *Calkins;* Indiana, *Underwood, VanHook 2171, 2194, 2436, 2566, 2587, Weir 55;* Tennessee, *Murrill 599;* Michigan, *Kauffman 1;* Montana, *Anderson 130;* Iowa, *Holway, G. W. Wilson, 1, 2, 3, 6;* Colorado, *Bethel, Demetrio, Seaver & Bethel;* Kansas, *Cragin 110, 557;* Arkansas, *Long 19851;* New Mexico, *Hedgcock & Long 9908;* Arizona, *Long 19725, 21373, 21394, 21395;* California, *Johnston 258;* North Carolina, *Murrill, Bartholomew 5661;* South Carolina, *Ravenel;* Georgia, *Ravenel;* Alabama, *Underwood;* Mississippi, *Tracy 185;* Louisiana, *Earle 10, Langlois;* Florida, *Calkins 31, 88, 119, 142, 921, Lloyd 2078, Mrs. Russell;* Cuba, *Britton & Wilson 5463;* Mexico, *Murrill 625, 626, 688, 690, Smith 42;* British Honduras, *Peck.*

W. A. MURRILL.

COLLECTING FUNGI NEAR WASHINGTON

The first two weeks in October, 1919, were spent by the writer in the vicinity of Washington, with excursions to Falls Church, Fairfax Court House, Great Falls, and Mount Vernon in Virginia; and to Baltimore, Reisterstown, and Easton in Maryland. Dr. Howard A. Kelly collected with me one afternoon near Falls Church, securing several specimens of fleshy fungi which he took home and had photographed or painted.

I went with a party of friends over some of the golf links in the suburbs of Washington and found the common field mushroom, the field puffball, the fairy ring mushroom, and a peculiar, large form of *Collybia radicata* which grew only under maple trees. All of these were eaten and enjoyed.

Clitocybe illudens was abundant in oak woods, particularly fine clusters being observed west of Falls Church and near the boat landing at Mount Vernon.

The journey to Easton, located on the Eastern Shore of Maryland over eighty miles from Washington, was especially interesting because Miss Mary E. Banning, a pioneer mycologist of

Maryland, was born in Talbot County. Dr. Kelly is preparing an account of her life and work. Her book of manuscript and drawings is at Albany, having been donated by her to the State Museum about thirty years ago. A list of the species she collected, comprising fourteen that were new, was published by Dr. Peck in his 44th annual report.

A day and night were spent at the home of Dr. Kelly in Baltimore, where Mr. L. C. C. Krieger, a botanical artist of great ability, is busily engaged in preparing illustrations of the fleshy fungi.

W. A. MURRILL.

THREE NEW FUNGI FROM PORTO RICO

The following fungi were collected by me in Porto Rico in 1913, 1914, and 1915, and were given to Mr. Lamkey to study. The descriptions and names were supplied by him.

Microstroma ingaicola Lamkey, sp. nov. Basidia clavate, 16–29 μ long, emerging through stomata in a crowded head; sterigmata minute; spores 4–8, hyaline 2–3 by 6–8 μ.

Producing witches' broom on *Inga laurina*. Mayaguez, Jan. 1914. No. 6711. The witches-brooms produced were large and numerous and quite as conspicuous as the brooms usually present on the hackberry in the states.

Microstroma pithecolobii Lamkey, sp. nov. Basidia clavate, 20–24 μ long, emerging through stomata in a crowded head; sterigmata minute; spores usually 8, hyaline, 2 by 8–10 μ.

Producing white hypophyllous spots on *Pithecolobium saman*. Mayaguez, Dec. 1913. No. 6734. The spots on the lower sides of the leaves were of the appearance of a Ramularia. The host was recently imported into Porto Rico and all of the planting was heavily infected though the fungus was not found on any of the other species of Pithecolobium so common on the island.

Peronoplasmopara portoricensis Lamkey, sp. nov. Conidiophores emerging through stomata, singly or in twos or threes, 80–300 by 5½–11 μ, pseudo-monopodially 3–5 branched, ultimate branches tapering and 9–18 μ long; conidia ellipsoid, hyaline, 14–24 by 16½–28 μ. Oöspores not present.

Forming irregular downy hypophyllous spots on *Melia azedarach.* Guanica, 1914. No. 6852. Florida Adentro No. 7687, 1915. This downy mildew was first collected in very scant quantity, on only a few small leaves near Guanica. The second collection, however, from a distant point on the island was ample, nearly all of the leaves of the tree being mildewed. The fungus is of especial interest since but few of the downy mildews grow on trees.

F. L. STEVENS.

AN EARLY AMERICAN RECORD OF MUSHROOM POISONING

There is an early record of mushroom poisoning in the old graveyard at Piscataway, near New Brunswick, New Jersey, which has not, so far as the writer is aware, been brought to the attention of mycologists interested in this matter. The record is in the form of an inscription on a tombstone and reads, as follows:

SPATATERS . VNDER .
NEATH . THIS . TOMB .
LIES . 2 . BOYES . THAT .
LAY . IN . ONE . WOMB .
THE . ELDEST . WAS . FVLL .
13 . YEARS . OLD . THE . YON .
GEST . WAS . V . TWICE .
TOLD . BY . EATING .
MVSHROOMS . FOR .
S
FOOD . RARE . IN . 1 . DAY .
TIME . THEY . POYSEONED .
. AR
WERE . RICHARD . HOOP
L
AND . CHARES . HOOPAR .
DESESED . AVGVST . ANNO .
DOM. 1695

The stone is a flat sandstone slab, about two and one-half by five feet in size. It is now badly weathered and promises to be-

come illegible in a few years. The first word is probably intended for "Spectators."

Both the deadly amanita, *Venenarius phalloides,* and the fly agaric, *Venenarius muscarius,* are extremely common in the vicinity of New Brunswick, but while in most localities the former is more abundant, in and around the old graveyard at Piscataway the fly agaric seems to be much commoner than its relative, suggesting that this species was the "food rare" which caused the untimely death of the two unfortunate youths and furnished the inspiration for the unknown epitaph writer.

GEORGE W. MARTIN.

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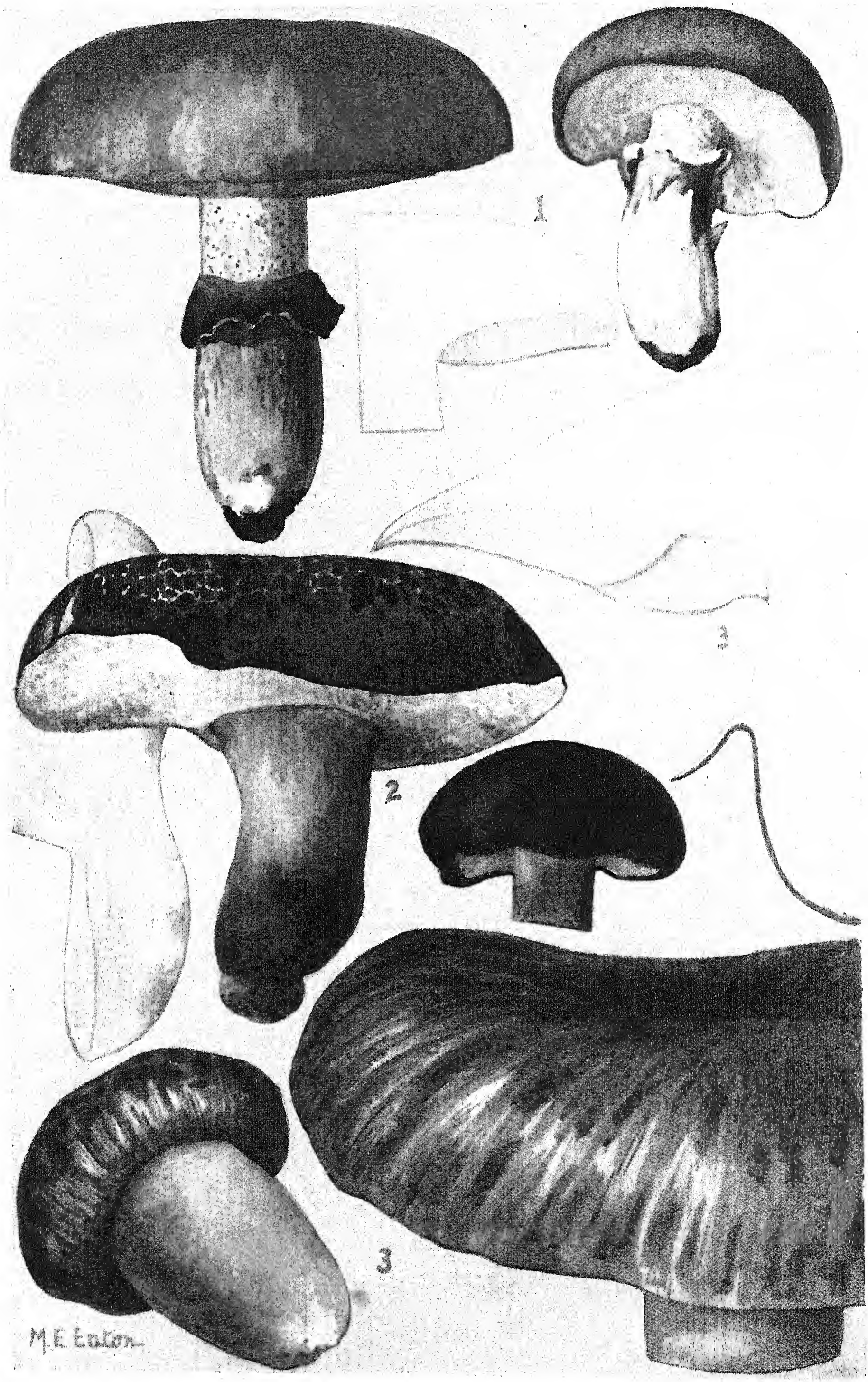
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M.E. Eaton

MYCOLOGIA

VOL. XII   MARCH, 1920   NO. 2

ILLUSTRATIONS OF FUNGI—XXXII

WILLIAM A. MURRILL

The species here illustrated are conspicuous and easily recognized by a number of good characters. Unfortunately, only one of them, *Boletus luteus,* occurs in sufficient quantity to be relied upon for food, but it is often very abundant and is one of the best edible species we have.

Boletus luteus L.

EGG-YELLOW BOLETUS

Plate 2. Figure 1. × 1

Pileus convex, solitary, 5–10 cm. broad; surface smooth, glabrous, very viscid, yellowish-brown, grayish-brown, or reddish-brown, sometimes streaked, becoming darker and duller with age; context compact, pale-yellowish, darker with age, unchanging when wounded, edible; tubes 1.5–2.5 mm. long, plane or convex in mass, adnate or slightly decurrent, somewhat depressed, dark-melleous, unchanging when wounded, darker with age, mouths 1 mm. in diameter, nearly circular, the edges adorned with reddish-brown dots; spores oblong-fusiform, smooth, yellowish-brown, $6–9 \times 2.5–4\,\mu$; stipe slightly tapering downward, pale-yellow to reddish-brown, glandular-dotted both above and below the annulus, solid, yellowish and unchanging within, about 3–6 cm. long, 1–2 cm. thick; annulus large, membranous, white to slightly brownish, glandular-dotted, persistent.

This large and striking edible species occurs in sandy soil in coniferous or mixed woods throughout Europe and the eastern United States, being more abundant in cooler regions. It exhibits several variations and has received several names, but is

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not easily confused with any poisonous species. Several years ago, after the pine trees had been set out around Conservatory Range 1, a single hymenophore of this fungus was found under one of them. In recent years, I have seen hundreds of specimens there, scattered far and wide beneath the trees, usually appearing in late autumn.

Tylopilus alboater (Schw.) Murrill

Boletus nigrellus Peck

BLACKISH BOLETUS

Plate 2. Figure 2. × 1

Pileus convex, solitary or gregarious, 6–10 cm. broad, 2 cm. thick; surface pruinose to tomentose, very dark brown to black, sometimes rimose-areolate; margin rather thick, involute when young; context white, changing to pinkish-gray when wounded, taste nutty; tubes adnate, slightly depressed, pale-gray to flesh-colored, changing slowly to black or reddish-black when wounded, 1 cm. long, mouths small, irregularly circular; spores oblong-ellipsoid, smooth, pointed at one end, dull-flesh-colored, 10–12 × 4–6 μ; stipe short, subequal, even, concolorous or a little paler than the pileus, pinkish-gray at the apex, velvety at the base, solid, 5–8 cm. long, 1.5–2.5 cm. thick.

This is apparently a rather rare species, originally described from North Carolina and occurring in open deciduous woods or groves from New York to Georgia and Mississippi. Peck found it at Sandlake, New York; and I found it once here under an oak in the rear of the Museum Building and had the accompanying drawing made from the specimens. Other specimens in the herbarium are: New Rochelle, New York, *Miss G. Cannon;* New York Botanical Garden, *A. J. Corbett;* Monmouth County, New Jersey, *Ballou;* Ohio Pyle, Pennsylvania, *Murrill;* Sunburst, North Carolina, *House;* Macon County, Alabama, *Earle;* Ocean Springs, Mississippi, *Mrs. Earle.* Hard figures specimens collected by him in Ohio and states that the species is edible and fairly good.

Armillaria nardosmia (Ellis) Sacc.

ALMOND ARMILLARIA

Plate 2. Figure 3. × 1

Pileus fleshy, firm, solitary, 6–9 cm. broad; surface fibrillose, whitish to lilac-avellaneous or pale-bay streaked with white, variegated with brown spots, especially near the center; cuticle thick, tough, separable; context white, thick and compact on the disk, thin toward the margin, odor aromatic; lamellae crowded, subventricose, slightly emarginate, whitish or cremeous; spores subglobose, 7 μ; stipe solid, fibrous, not bulbous, sheathed below by the brown, velvety veil, 7 cm. long, 1–3 cm. thick; annulus narrow, spreading, uneven on the edge.

This species was originally described from New Jersey and is known to occur sparingly in oak or mixed woods from Massachusetts to Virginia in the eastern United States. I have it from Massachusetts, *G. E. Morris;* Long Island, *Dr. Bauer;* Forked River, New Jersey, *Ballou;* Newfield, New Jersey, *Ellis;* Takoma Park, Maryland, *Shear, T. A. Williams;* Falls Church, Virginia, *Mrs. Murrill.* Hard reports it from Chillicothe, Ohio, and says that its taste and odor of almonds or spikenard disappears in cooking.

NEW YORK BOTANICAL GARDEN.

ON CERTAIN ENTOMOGENOUS FUNGI

A. T. Speare

(With Plates 3–5)

I

The Genus Hirsutella of Patouillard

While it is customary to think of the entomogenous fungi as members for the most part of the groups Entomophthorales, Ascomycetes and Fungi Imperfecti, there are in literature several records in which such a habit has been attributed to certain Basidiomycetes. Among the latter may be mentioned the various species of *Septobasidium* and the form called *Hirsutella entomophila* by Patouillard.

The present paper deals with certain fungi that are evidently closely related to the latter. It will be shown, however, that they should not be considered as Basidiomycetes, but rather that they should be looked upon as constituting a rather definite form genus of the Fungi Imperfecti, with which group they must apparently be associated until the perfect stages are found.

The paper by Patouillard (1892) in which *Hirsutella entomophila* is described, although without illustrations, is otherwise quite comprehensive, and there is little doubt in the opinion of the writer that the fungus mentioned is closely allied to members of the group herein considered, and in fact it is looked upon as identical with one of them.

The description of *Hirsutella entomophila* may be quoted in order that it may be readily compared with those of the other species noted below.

"Hirsutella Pat. nov. gen. Hymenomycétes, homobasidiés, en forme de clavaires, simples ou rameux, dressés, rigides, presque coriaces. Hymenium amphigène, disjoint; basides sessile ou presque sessiles; sous-hymenium nul; stérigmates 1–2, subulés, très allongés. Spores incolores.

"*Hirsutella entomophila* Pat. nov. spec. ———. Sur coléoptère adulte; Pallatanga, Equateur, Septembre 1891.

"*Mycelium* émergent du corps de l'insecte sous forme de filaments grêles (2–3 microns) entrelacés en un tomentum gris-cendré. Clavules nombreuses, petites (3–5 mm., de haut), grêles, rigides, simples, cylindracées, aigues et sterile au sommet, d'un gris-violace, blanchâtres a l'extrémité. Basides sessiles ou subsessiles ovoides (8–10 × 5–6 microns) ; stérigmate unique, subulè, trés allongé, un peu renflé a sa partie infèrieure et mesurant 30–45 microns de longueur. Spores hyalines, citriformes, 8 by 6 microns, apiculées aux deux extrémités."

In comparing *Hirsutella* with other members of the lower Clavariaceae, Patouillard observed certain characters of the former such as, for example, the extraordinary length of the sterigmata, the lack of a definite continuous hymenium, the coriaceous consistency of the "clavules," and the complete absence of a subhymenium, that were not shared by any genera of the true Clavariaceae, and suggested because of such differences that a new genus (*Hirsutella*) be formed to receive his anomalous species. In reality the characters noted above are of such a nature that it is difficult to understand why the fungus should have been considered as a Basidiomycete at all. In dealing with the species as a member of this family, however, Patouillard looked upon the inflated base of the sporophore as the basidium, and considered the attenuated distal portion of the same organ as the sterigma, noting that only one of the latter was borne on each basidium. The true nature of the "basidiospores" was apparently not observed for they were described as "citriforme" in shape, whereas, careful microscopic studies of stained and unstained spores by the writer have shown that they are in reality fusiform in outline, although mucus is deposited about the spores in such a way as to render them uniformly lemon-shaped.

In addition to the paper mentioned above, there are in literature several references to fungi of this type which should be mentioned in this connection. Ditmar (1817) described as *Isaria sphaecophila* a fungus occurring on a hornet which shows a certain resemblance to forms herein considered. The illustrations furthermore suggest such a relationship. The spores were said to be globose and hyaline and were entangled among short, rigid hairs which arose at right angles to the synnemata.

Cooke (1892) described as *Isaria saussurei* pro. tem. another hornet parasite. The fungus was originally figured only by

Saussure (1853) but the illustration was later copied by Gray (1858) and still later by Cooke, the latter venturing to give it the name mentioned above. In general appearance it bears a close resemblance to a form on *Polistes* that was brought to the attention of the writer in Hawaii, which is closely allied to *Hirsutella entomophila,* and although no microscopic characters of *I. saussurei* were ever recorded, there seems to be no good reason for considering it different from the Hawaiian and other forms mentioned below.

The writer (1912) considered under the name "Sterile Cordyceps" a fungus that was found upon specimens of *Perkinsiella saccharicida* in Hawaii, and at that time being unfamiliar with Patouillard's paper did not suspect the now evident relationship of this form with *Hirsutella entomophila.*

The description and figures by Vosseler (1902) of *Isaria surinamensis* sp. nov. and *Isaria gracilis* sp. nov., two species occurring on *Amphonyx cluentus* and *Anthophora zonata* respectively, clearly show a resemblance to the fungi herein considered. In gross appearance, in the microscopic structure of the synnemata, both of these forms show characters in common with those of *Hirsutella,* and while the sporophores appear at first sight somewhat different from the analogous organs of *Hirsutella,* it should be noted that in old specimens of the latter only the basal portions of the sporophores persist and that the attenuated terminal portions are somewhat delicate and disappear after the spores are formed. Furthermore, in many instances development of the sporophores seems oftentimes to be arrested so that only the stump like inflated basal portions are formed. In such cases a condition, Plate 3, Fig. 6, is brought about that is quite like that illustrated by Vosseler on his Plate VIII, Figs. 3 and 9.

Vosseler has not made clear either by figures or by text, however, the nature and method of formation of the bodies which he calls the spores. His illustrations of these bodies show no resemblance to the spores of *Hirsutella,* and on account of the fact that he was unable to show how they were formed, it is evident that he possessed old specimens in which the true fruiting stage had disappeared, and that the spores which he described should probably not be associated with the fungi mentioned.

There is little doubt therefore in the opinion of the writer that *Isaria surinamensis* Voss. and *I. gracilis* Voss. (not *Isaria gracilis* Speg.), should be associated with the forms herein considered, but whether or not they are identical with any of the species described below cannot be determined from the data at hand.

Thaxter (1891) described an interesting fungus, *Desmidiospora myrmecophila,* which was found on an ant in Connecticut. While its resting spores are anomolous in character, and although no structures analogous to the synnemata of *Hirsutella* were described, its subulate sporophores and fusoid spores are of the same type as the corresponding organs of the forms under consideration.

In this connection, it should be noted that von Höhnel (1909) agrees with the writer in concluding that fungi of this type should be removed from the genus *Isaria.* He proposed, however, a new genus of Hyphomycetes, *Phaeoisaria,* to include among other things *Isaria surinamensis* Voss., *I. gracilis* Voss. and *I. sphaecophila* Ditm., but it is evident that if any name other than *Isaria* is to be used for fungi of this type it must be *Hirsutella.*

The published information on the subject and the specimens at hand show that such fungi are found upon members of all of the larger insect orders except the Diptera, and Dr. Roland Thaxter, of Harvard University, has informed the writer that he has in his herbarium similar fungi on flies. The hosts, so far as known at the present time, may be noted in detail in the following table.

A glance at this table will show at once that of the specimens at hand the greater part have come from tropical or subtropical regions, and also that the greater number of hosts are found among the Hemiptera, the family Fulgoridae being particularly conspicuous. Furthermore, it will be noted that two of the hemipterous hosts—*Peregrinus maidis* and *Perkinsiella saccharicida*—are pests of considerable economic importance in the localities mentioned.

The illustrations on Plate 3 show the general character of the fruiting stalks or synnemata, which in all of the species but one,

herein considered, are of the same general nature. To the naked eye the synnemata appear as long, simple or branched, often spirally twisted, *Isaria*-like stalks, which at maturity are brownish in color or sometimes almost black. They are more or less rigid in all of the species and retain their form in old preserved specimens. A dozen or more may occur on one host, Plate 5, Figs. 1, 3 and 4, and while in certain cases they appear to arise from a cottony external subiculum, in other instances it is evident that they emerge directly from the body of the host. In the form on *Peregrinus* however, the synnemata do not assume the stilbaceous habit characteristic of the other species, being in this instance little more than papillate or verruciform outgrowths seated upon a noticeably conspicuous external subiculum of hyphae which is itself sporiferous.

	Host	Host determined by	Collected by	Locality
Hemiptera.	Fulgoridae.	E. H. Gibson.	O. H. Swezey.	Auckland, N. Z.
	Fulgoridae.	E. H. Gibson.	J. H. Stevenson.	Rio Piedras, P. R.
	Ricania discalis Walk.	E. H. Gibson.	O. H. Swezey.	Auckland, N. Z.
	Siphanta acuta.	O. H. Swezey.	O. H. Swezey, A. T. Speare.	Hawaii.
	Peregrinus maidis	A. H. Ritchie.	A. H. Ritchie.	Jamaica.
	Perkinsiella saccharicida.	?	F. W. Terry.	Hawaii.
Hymenoptera.	*Polistes annularis.*	S. A. Rohwer.	R. W. Leiby.	Raleigh, N. C.
	Wasp.		C. V. Riley?	California.
	"		?	West Virginia.
	Polistes sp.		M. Newell.	Hawaii.
	"	?	(Ditmar) ?(*I. sphaecophila*).	Germany.
	"		Saussure (*I. saussurei*).	
	Anthophora zonata.	?	Gedé ?(*I. gracilis*).	Java.
	Wasp.		Hohnel ?(*I. gracilis*).	"
Coleoptera.	*Diabrotica* sp.	W. S. Fisher.	H. Morrison.	Trinidad, B. W. I.
	Chrysomelidae.	?	Lagerheim.	South America.
Orthoptera.	Cricket.		A. T. Speare.	Hawaii.
Lepidoptera.	*Amphonyx cluentus.*	?	Epp. ?(*I. surinamensis*).	Surinam.

In all of the species the synnemata are composed of numerous somewhat interwoven but nearly parallel septate hyphae that

adhere to one another tenaciously. The character of the fruiting stalk is illustrated on Plate 3, Fig. 1. Certain of the hyphae which lie near the surface of the stalk produce short, usually sessile subulate sporophores and while there is some variation in the shape of these bodies in the different species, they invariably have swollen or inflated basal portions which in all of the forms are surmounted by single extremely long, attenuated sterigmata. It should be noted, however, that many specimens, particularly old ones, do not show such a richly developed sporiferous condition as that illustrated, because development of the sporophores seems to cease in many instances when the inflated basal portions only are formed. Furthermore, after spore formation, the sterigmata often collapse, leaving the swollen basal portions however, in situ, rendering a condition quite comparable to that figured and described by Vosseler for *Isaria surinamensis.*

The spores which are borne singly at the tips of the sterigmata vary from fusoid to allantoid to cylindrical in the different species and are also somewhat variable in size. In all cases a gelatinous substance surrounds them which if carelessly examined might be considered as a part of the spores. That this substance is a secondary product can be determined by examining regions of the synnemata where the spores are being formed. In such positions the newly formed spores are naked and definitely of the fusiform type. Furthermore, if the spores on adjacent sporophores come in contact with one another their matrices coalesce in a manner such as that illustrated on Plate 3, Fig. 16, demonstrating that no cell wall is present.

In all cases the parasitized hosts are fixed to the substrata by undifferentiated rhizoidal hyphae.

As noted in the paper cited above (Speare 1912) it is probable that these forms are the imperfect stages of one or more species of *Cordyceps* or related genera. Actually, however, such a relationship has not been proven in a single instance either by pure culture, continuity of development, association in the same stroma, or other means. Furthermore, while the writer has collected and examined hundreds of specimens of the species which occurs in epidemic form on *Siphanta acuta* in Hawaii, no perfect

stage has been observed, and although specimens of the other parasitized hosts at hand are much more limited in number, an acigerous stage has not been observed in connection with any of them. While therefore it is probably true that these forms are the imperfect stages of *Cordyceps* or an allied type, the condition that is likely to be met with in the future is that mentioned above. This is deemed by the writer as sufficient reason for describing the following imperfect stages, and although recognizing their probable relation to *Cordyceps* it seems advisable for the present to retain the name *Hirsutella* for the genus, members of which are unlike any other described entomogenous forms known to the writer, although in accepting this name care should be taken not to associate it with the Basidiomycetes, with which it evidently is in no way connected. The genus *Hirsutella* should be looked upon in the same manner as is *Gibellula* and other genera that have been removed from the composite genus *Isaria*, and in accordance with this conception the following description may be given.

HIRSUTELLA Pat.

Fruiting bodies in the form of simple or branched, long, erect, slender and rigid, or short verruciform synnemata composed of more or less parallel septate hyphae. Sporophores simple, sessile or subsessile, subulate, the distal portion extremely long and attenuated and sharply set off from the swollen or inflated basal portion. Spores adjointed singly from the tips of the sporophores, fusoid, allantoid or cylindrical in form, hyaline, one-celled, their true shape obscured by a gelatinous substance which surrounds and renders them citriform in appearance.

The specimens in the writer's possession are clearly separable into five species, which are distinguished from one another largely on the characters of the spores and sporophores.

1. HIRSUTELLA ENTOMOPHILA Pat.

Entomogenous. Synnemata arising directly from the body of the host 5–15 mm. long, much branched, rigid, often spirally twisted, brownish in color, sometimes fasciculate with their bases coalescing. Sporophores simple, sessile, the basal portion inflated but short, tapering gradually into relatively short (25–35 microns) sterigmata. Spores fusiform, 7.5×1.5 microns, hyaline, imbedded in gelatinous matrices.

Host: *Diabrotica* sp. (adult) Trinidad.

The above description is based upon a specimen from Trinidad, British West Indies, which is believed to be identical with the form described by Patouillard. The measurements of the spores (8 × 6 microns) as given by this author, apparently included the gelatinous substance surrounding the spores.

2. HIRSUTELLA SAUSSUREI (Cooke) comb. nov.

Isaria saussurei Cooke, pro. tem.

?*Isaria gracilis* Vos.

Entomogenous. Synnemata arising directly from the body of the host, usually very long (20–30 mm.), flexible, somewhat branched, more or less erect, brownish in color. Sporophores simple, sessile, the basal portion inflated, short, tapering rather abruptly to the usually very long (35–70 microns), slender sterigmata. Spores allantoid, 9–11 × 1–1.5 microns, hyaline, imbedded in gelatinous matrices.

Hosts: *Polistes annularis* (adult), North Carolina.
Polistes sp. (adult), Hawaii.
Polistes sp. (adult), California.
Polistes sp. (adult), British West Indies.

This species is readily distinguished from the others herein described by its long, narrow, and usually allantoid spores, as well as by its extremely slender sterigmata that are but slightly swollen at the base. *I. gracilis* Voss. has been included as a possible synonym but as the description of this fungus includes no discussion of the spores or other microscopic characters it is impossible to treat it more satisfactorily.

3. **Hirsutella floccosa** sp. nov.

Entomogenous. Synnemata short, verruciform, white, arising from a cottony subiculum. Sporophores simple, sessile, extremely robust, the swollen basal portion tapering very gradually into the short, rather stumpy sterigmata (10–15 microns); spores fusoid, hyaline, 9–10 × 3.2–3.8 microns.

Host: *Peregrinus maidis,* Jamaica, B. W. I.

This species is somewhat unlike those described above, in that the synnemata are merely wart-like outgrowths arising from an

external cotton-like subiculum. The spores and sporophores are also larger and more robust than similar bodies of the other species.

It should be mentioned that the characters of the spores and sporophores bear a certain resemblance to the analgous structures of *Acremonium danysz* Wize (1904), a parasite of *Cleonus punctiventris* in Russia.

4. **Hirsutella citriformis** sp. nov.

Entomogenous. Synnemata usually long, flexible, arising sometimes from a subiculum, sometimes directly from the body of the host, brown in color, simple or branched. Branches often short and stumpy, and easily detached. Sporophores simple, sessile or subsessile, with rather short, delicate sterigmata (20–30 microns). Spores fusoid, hyaline, $5.5–8.5 \times 1.5–1.8$ microns in size, imbedded in gelatinous matrices.

Hosts: Fulgoridae (adult), New Zealand.
Fulgoridae (adult), Porto Rico.
Ricania discalis, New Zealand.
Perkinsiella saccharicida, Hawaii.
Siphanta acuta, Hawaii.

5. **Hirsutella fusiformis** sp. nov.

Entomogenous. Synnemata erect, straight, unbranched, uniform in height, measuring 4–5 mm., nearly black in color, arising from the leg joints and sutures of the host's body, singly. Sporophores simple, sessile, the inflated basal portion tapering gradually to rather short (25–35 microns) sterigmata. Spores fusoid-cylindrical, measuring $9–10 \times 2$ microns in size, hyaline, imbedded in gelatinous matrices.

Host: Cricket (adult), Hawaii.

It is quite impossible from the data at hand to determine whether or not *Isaria surinamensis* Voss. is identical with any of the above species. In the writer's opinion, however, it undoubtedly is closely related to them and should therefore be placed in the genus *Hirsutella,* and if distinct it should be called *H. surinamensis* (Voss). In a similar manner it is difficult to ascertain the true nature of *Isaria sphaecophila* Ditm., and though

probably this species belongs with the fungi mentioned above, it should perhaps be regarded as a distinct form on account of the knob-like processes which occur upon the synnemata.

II

Synnematium Jonesii gen. et sp. nov.

This fungus was found upon specimens of *Mezira emarginata* Say. and *M. lobata* Say.,* which were sent to the writer by T. H. Jones of Baton Rouge, La.

Although a large number of the insects showed the *Isaria*-like synnemata which characterize the fruiting stage of the organism, other specimens, although dead, showed no external signs of fungus parasitism. The latter were placed in a moist chamber and in a few weeks fruiting bodies of the fungus, Plate 5, Fig. 5, appeared on all but one or two of the individuals.

Artificial cultures on potato agar were readily obtained from the fresh viable material, and at the present time the organism is growing vigorously, although it has been sub-cultured several times since the original isolation in March, 1919.

The fruiting bodies of this form, like those of *Hirsutella*, consist of erect, stilbaceous fascicles of cohering hyphae. When young, Plate 5, Fig. 5, the fascicles are white and the hyphae of which they are composed are loosely coherent, presenting a flocculent appearance such as that illustrated. Later in their development, however, the synnemata are brown in color, and the hyphal elements are more closely associated so that a fully developed fruiting body appears to the naked eye quite like that of *Hirsutella* or like the fruiting stalk of many species of *Cordyceps*.

The structure of the stalk is illustrated on Plate 4, Fig. 1. The sporophores which are produced at the sides and at the tips of the synnemata are long and slender, tapering gradually and uniformly from the base to the tip, in this respect being unlike the homologous organs of *Hirsutella*. Those at the tip of the synnemata, while clearly differentiated from the elements of the

* Determined by Prof. H. M. Parshley through the courtesy of Mr. E. H. Gibson.

stalk, remain closely applied to one another and definitely terminate the growth of the fruiting body. Those at the sides of the synnemata usually occur singly. The spores are abjointed successively from the tips of the sporophores and become incorporated in a mucus like substance that is secreted copiously during the process of spore formation, Plate 4, Fig. 1, in such a way that globular spore masses are produced. The largest of these which are formed at the tips of the synnemata where the sporophores are grouped together are easily observed with the naked eye, and appear at first like the deliquescent, translucent sporangia of certain mucors. Later they become brown or almost black.

In addition to the spores, which are thin-walled and evidently formed for the purpose of infecting other insect hosts when favorable conditions obtain, a second type of reproductive body is produced, the object of which is apparently to tide the fungus over unfavorable conditions. These bodies, the sclerotia, are formed at the tips of certain branches of the synnemata in the manner illustrated on Plate 4, Fig. 3. The method by which they are produced has not been studied in detail, but such observations as have been made indicate that certain of the distal hyphae of the synnemata become twisted, knotted and intertwined about each other in such a way that spherical masses are produced, which after further development assume the appearance of typical sclerotia. These bodies usually appear after spore formation has reached its maximum, or even ceased, and in many instances entire synnemata become involved in their formation so that old tube cultures often contain only the sclerotia, which are formed in large numbers and easily become detached from one another and roll about the tube. At maturity they are brownish in color and roughly spherical, Plate 4, Fig. 6. When crushed, the elements of which they are composed separate from one another readily, and it will be observed that they are very thick-walled, Plate 4, Fig. 7, 9, and irregular in outline. When placed in sterile water, germination may take place at once, although it is obvious that because of their thick walls they are primarily intended to function as resting spores. In germinating,

the cell-wall apparently becomes in part absorbed by the protoplasmic contents of the cell, or at least becomes very much thinner, and a germ tube is pushed out, in the manner illustrated on Plate 4, Figs. 8 and 15, upon the tip of which a thin-walled spore of the type described above is cut off. The sclerotia when placed in a moist chamber produce fascicular hyphal outgrowths as shown on Plate 4, Fig. 5, which produce sporophores, and upon the latter thin-walled spores are abjointed that in every respect are similar to those described above.

The characters of this fungus as outlined above are of such a nature that in the opinion of the writer it cannot be associated with any other known genus of the Hyphomycetes. It is obviously of the stilboid type but the sporophores are borne upon the synnemata acropleurogenously and the spores are abjoined successively becoming incorporated in globular mucous masses, conditions that do not occur in association in any other form known to the writer.

In some respects it is not unlike members of the genus *Stilbum,* some species of which, such as *S. buquetii, S. kervillei, S. coccophilum,* etc., have furthermore been considered as entomogenous, but as the sporophores in the form under consideration are borne pleurogenously as well as acrogenously, and are well differentiated from the elements of the synnemata, it cannot be associated with the other members of the genus *Stilbum.* On the other hand it bears a certain resemblance to *Hirsutella, Sorosporella,* and in a certain degree to *Gibellula.* The characters of *Hirsutella* have been considered in the preceding pages and a glance at Plate 3 will show at once the similarity and at the same time the difference that exists between it and *Synnematium.* In *Sorosporella,* as the writer and others have pointed out, resting spore masses are produced, which although formed within the body of the insect are nevertheless analogous to the sclerotia of *Synnematium,* and furthermore a stilbaceous condition has been observed in *Scrosporella* which is not at all unlike that which occurs in the form under consideration. In general, it may be said that the species of *Hirsutella, Sorosporella, Gibellula,* and *Synnematium* resemble one another in that the stilbaceous fruit-

ing body is common to all, and, furthermore, with the exception of *Gibellula* a conspicuous bottle-shaped or subulate sporophore is invariably present in some form or modification, while at the same time the fusiform type of spore is present in each instance. It is also to be noted that in all of the above-mentioned genera with the exception of *Gibellula,* a viscous substance is secreted apparently by the spores, which might aid them in attaching themselves to new hosts, which, although not formed abundantly in *Sorosporella,* is supposed to be present because the spores cohere to one another after they are cut off. In *Hirsutella,* in which the spores are abjointed singly, this substance assumes a rather definite form, rendering the spores falsely citriform in outline, whereas in *Synnematium* as has been pointed out, it is secreted copiously and the successively formed spores become incorporated in it, forming large glomerules.

The characters of *Synnematium* are, therefore, sufficiently different from other forms known to the writer to justify a new name and the following description is therefore given.

Synnematium gen. nov.

Entomogenous. Fruiting bodies in the form of erect, dendroid synnemata, arising directly from the body of the host, at first white, later brownish in color. Sporophores borne laterally and terminally on the synnemata, the lateral ones occurring singly, the terminal ones fasciculate, sessile, uniformly and gradually attenuated from base to apex. Spores fusiform, hyaline, one-celled, abjointed successively, cohering in glomerules of mucus at tips of sporophores.

Synnematium Jonesii sp. nov.

Synnemata 5–10 mm. high, 100–200 microns in diam. At first whitish, flocculent, later brown and almost coriaceous, much branched, often tree-like. Sporophores in part arising as lateral branches of the elements of the synnemata, in part forming the terminal growth of the fruiting stalk, in the first instance occurring singly, in the second being fasciculate; in both cases nonseptate and clearly differentiated from the synnemata. Sporophores 40 microns long, gradually attenuate upward from base, which is 3.4 microns in diameter. Spores fusiform, hyaline, one-celled, 8–10 by 4–5 microns, borne successively and cohering after

they are cut off in mucus glomerules. Sclerotia 125–200 microns in diameter, roughly spherical, at first white, later brown in color. Elements of sclerotia very irregular in form but roughly spherical, measuring 10–15 microns in diam. provided with very thick (4–6 microns) walls.

Hosts: *Mezira emarginata* Say, Louisiana, U. S. A.
Mezira lobata Say.

BUREAU OF ENTOMOLOGY,
UNITED STATES DEPARTMENT OF AGRICULTURE,
WASHINGTON, D. C.

EXPLANATION OF PLATES

PLATE 3

Figs. 1–5. *Hirsutella saussurei.* (1) Portion of end of a synnema. × 532. (2) Middle portion of synnema showing method of branching. × 92. (3) Sporophore with attached spore. × 1048. (4) Sporophore. × 1048. (5) Spores.

Figs. 6–9. *Hirsutella fusiformis.* (6) Portion of a synnema. × 568. (7–8) Spores. × 1048. (9) Sporophore.

Figs. 10–11. *Hirsutella floccosa.* (10) Spores. (11) Sporophores. × 1048.

Figs. 12–13. *Hirsutella entomophila.* (12) Sporophore. (13) Spores. × 1048.

Figs. 14–15. *Hirsutella citriformis.* (14) Sporophores and spores from *Ricania.* (15) Abnormal development from *Siphanta acuta.* × 1048.

Fig. 16. Spores of *H. saussurei, H. citriformis,* and *H. fusiformis* imbedded in a mucus-like substance. × 568.

PLATE 4

Synnematium Jonesii

Fig. 1. Terminal portion of a synnema showing (*a*) isolated lateral sporophores, (*b*) massed terminal sporophores, (*c*) mucus glomerules of spores. × 92.

Fig. 2. Terminal portion of a synnema showing a secondary growth arising from beneath the spore mass of the primary growth. × 92.

Fig. 3. Fruiting stalk showing sclerotia in situ. × 50.

Fig. 4. Portion of a synnema with sporophore in situ. × 1048.

Fig. 5. Sclerotium germinating on agar plate culture. × 65.

Fig. 6. Sclerotia. × 92. Fig. 7, cells of sclerotia. × 568. Fig. 8, the same germinating. × 568. Fig. 9, cell of sclerotium. × 1048.

Figs. 10–11. Spore glomerules. × 1048 and × 568.

Fig. 12. Spores. × 1048.

Fig. 13. Spore germinating. × 1048.

Fig. 14. Cells of sclerotium germinating. × 400.

Fig. 15. Single cell of sclerotium germinating. × 1048.

PLATE 5

Fig. 1. *Hirsutella saussurei* (Cooke) on *Polistes annularis.* × ¾.

Fig. 2. *Synnematium jonesii* Speare on *Mezira emarginata,* showing sclerotia. × 4.5.

Fig. 3. *Hirsutella citriformis* Speare on *Siphanta acuta.* × 1.

Fig. 4. *Hirsutella entomophila* Pat. on *Diabrotica* sp. × 1.8.

Fig. 5. *Synnematium jonesii* Speare on *Mezira emarginata,* showing synnemata. × 3.

Fig. 6. *Synnematium jonesii* Speare. Colony of the fungus growing in artificial culture. × 2.5.

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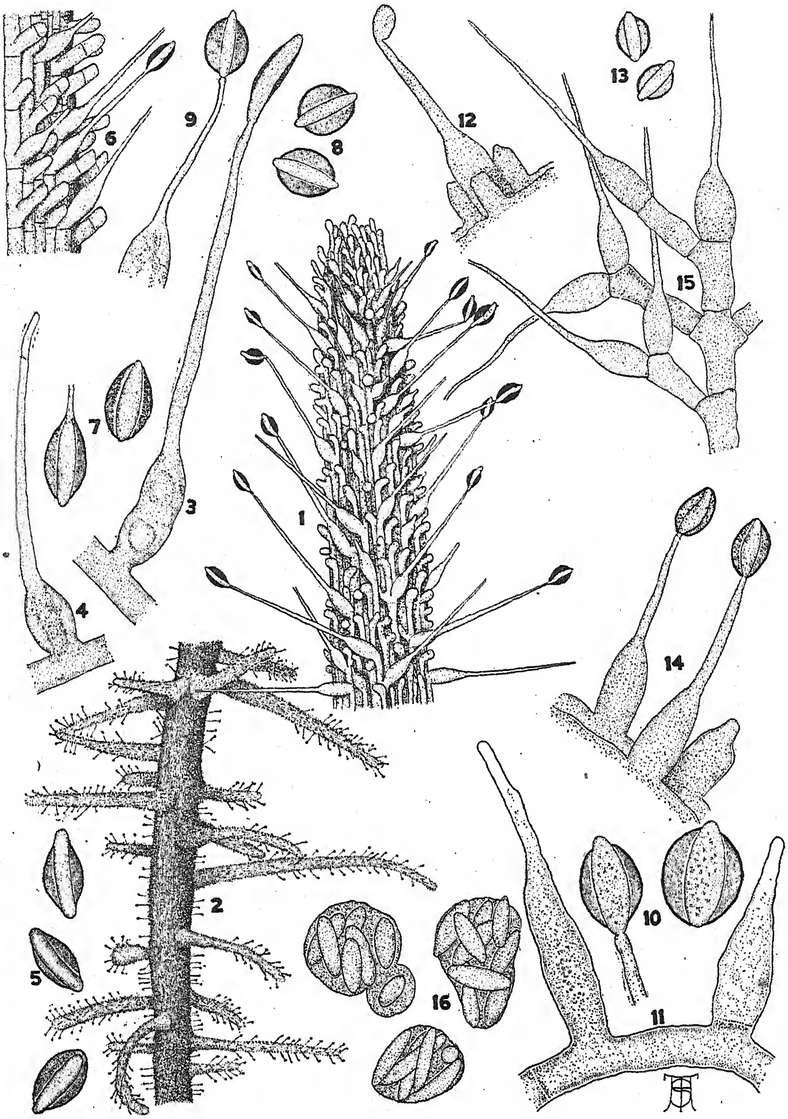
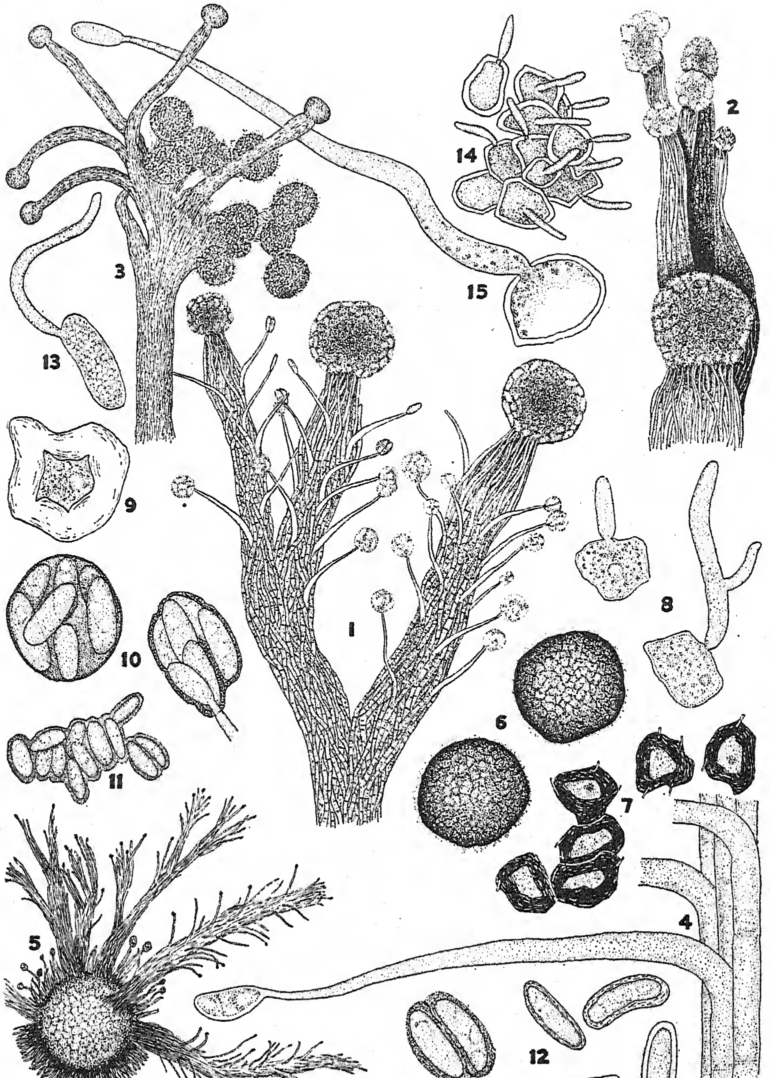
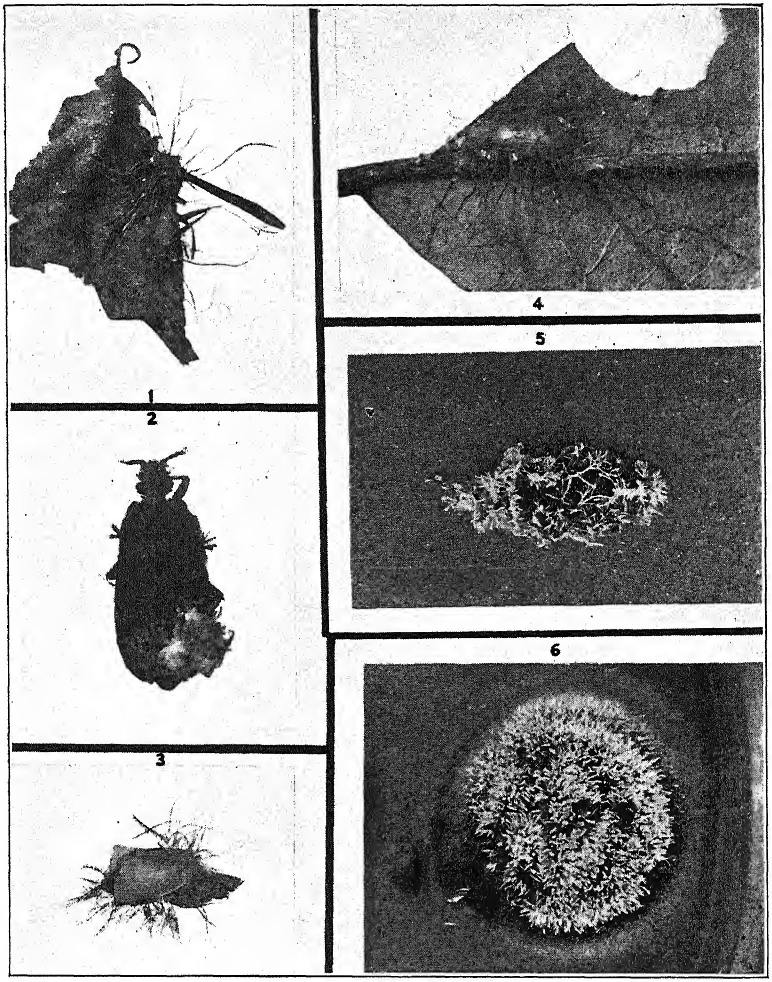


HIRSUTELLA



SYNNEMATIUM JONESII SPEARE



HIRSUTELLA AND SYNNEMATIUM

LIGHT-COLORED RESUPINATE POLYPORES—I

WILLIAM A. MURRILL

In *Mycologia* for September, 1919, preliminary notes were published on 35 species of *Poria* described from North America, and, in the January number, *Trametes serpens* and *Poria medullapanis* were considered. None of Peck's species have been included because these were discussed in detail by Overholts in Bulletin 205–206 of the New York State Museum, published in June, 1919.

It is now my intention to take up various white, gray, yellow, rose-colored, and purple species that occur in temperate and tropical North America and make notes on their history, distinguishing characteristics, hosts, distribution, etc. The object I have in view is not to publish at this time a comprehensive systematic treatment of the group, but to stimulate collectors throughout the country to observe, collect, and study these difficult resupinate forms in the fresh condition, noting spore measurements, colors, and other perishable characters.

The descriptions included are mainly from dried specimens. Before the hundreds of such specimens in the herbarium here can be intelligently discussed, referred to, or classified, they must be named—and more complete descriptions can be prepared later.

The numbers following the collectors' names are those found accompanying the specimens. Sometimes they are only determination numbers and mean nothing except to the collector.

1. PORIA ALABAMAE (Berk. & Cooke) Cooke, Grevillea 14: 113. 1886

Polyporus Alabamae Berk. & Cooke; Berk. & Curt. Grevillea **6**: 130. 1878.

Described from specimens collected by Ravenel at Gainesville, Florida, on branches of *Myrica cerifera*. Certain forms of this

species and of *P. medullapanis* resemble each other closely in external appearance. The following specimens of *P. Alabamae* have been examined:

Rav. Fungi Am. *100;* Florida, *Calkins 90, 164, 149, 183, 842, 843, 921, Lloyd 2130* (in part), *Ravenel;* Mississippi; Mexico, *Murrill 679.*

Polyporus roseo-isabellinus and *P. isabellinus,* described by Patouillard and Gaillard from Venezuela in 1888, should be carefully compared with *P. Alabamae.* The spores of the former are said to be ovoid, $6 \times 8\,\mu$, while those of the latter are described as ovoid, $13 \times 8\,\mu$. Externally, the types are much alike.

2. PORIA VAPORARIA (Fries) Cooke, Grevillea 14: 111. 1886

It is unfortunate that the type of this species does not exist in the herbarium of Persoon, but it is probably identical with *Polyporus Vaillantii* (DC.) Fries, which Hennings found in pileate form at Berlin and discussed in an illustrated article published several years before his death. This plant is common in the greenhouses of Europe, often appearing in abnormal forms. I have seen no American material to match it closely.

The plant generally called by this name, however, both in Europe and America, is Fries' misconception of Persoon's species. This is abundant with us and is quite well recognized except where confused with certain forms of *Irpex*. *Polyporus sinuosus* Fries (not *Irpex*), *Physisporus rixosus* P. Karst., *Physisporus serenus* P. Karst., and *Physisporus luteoalbus* P. Karst. are closely related European species.

The only synonym available for use appears to be *P. incerta,* which is much more appropriate than *P. vaporaria,* since the plant is not common in greenhouses—although any change is unfortunate.

Poria incerta (Pers.) comb. nov.

Polyporus (Poria) vaporarius Fries, Obs. Myc. 2: 260. 1818.
Not *Poria vaporaria* Pers. Tent. Disp. Fung. 1: 70. 1797.
Boletus incertus Pers. Myc. Eur. 2: 106. 1825.

Described from Europe, on dead wood of pine and other trees. Bresadola characterizes it as follows:

"Color ex albido ligneus; pori ampli, rotundati vel angulati, non flexuosi nec daedaloidei; sporae hyalinae, cylindraceo-curvulae, mobiles, 4×1–$1\frac{1}{4}\ \mu$; hyphae contextus crassiuscule tunicatae, septatae, ad septa saepe unilateraliter nodosae, $2\frac{1}{2}$–$3\ \mu$."

This species attacks a variety of hosts, apparently preferring pine, fir, spruce, and other conifers, in the wood of which it produces a brown rot. Other hosts represented in our collection are: American elm, American linden, maple, oak, alder, hickory, beech, white cedar, yellow birch, wild black cherry, orange, and old fruit-bodies of various polypores. The following specimens have been examined:

Ellis & Ev. Fungi Columb. *101, 101b;* Ellis, N. Am. Fungi *9*; Karst. Finl. Fungi, *518*; Rab.-Wint. Fungi Eur. *3434;* Rav. Fungi Am. *711*, *712*, *713*; Rav. Fungi Car. *19*; Roum. Fungi Sel. *4306*; Sydow, Myc. Mar. *1802*; Poland, *Eichler;* England, *Baker, Carlyle, Cooke, Massee;* Canada, *Macoun 219, 241*; Maine, *Murrill 1745*; Connecticut, *Underwood;* New York, *Cook, Dodge & Seaver, Underwood;* New Jersey, *Anderson, Ellis, Underwood;* Pennsylvania, *Haines & Everhart, Murrill 1299*; Delaware, *Commons 2169*; West Virginia, *Nuttall;* Ohio, *Lloyd 1584, 3129, Morgan 118*; Indiana, *Van Hook 2033*; Missouri, *Demetrio 659*; Arkansas, *Long 19851*; Kansas, *Bartholomew;* Colorado, *Seaver & Bethel;* Iowa, *G. W. Wilson 4*; Idaho, *Weir 71*; Oregon, *Carpenter;* California, *Harper;* Alabama, *Earle 71, Underwood;* Louisiana, *Atkinson* (*Cornell Univ. Herb. 5123*), *Langlois 1272, 1886, 2033, 2423*; Florida, *Calkins 541, 738, 799, 862, 923, 924*; *Lloyd 2130*; Bermuda, *Brown, Britton & Seaver 1371*; Cuba, *Earle & Murrill 478, 540, 610*; Porto Rico, *Stevenson 2857, 2915*; Jamaica, *Earle 64, 395, Murrill 340, 668, Murrill & Harris 945*; St. John, *Raunkiaer 190, 207*; St. Croix, *Raunkiaer 174*; Mexico, *Murrill 214, 241, 242, 263½, 631, 635, 660, 998, C. L. Smith 47.*

3. PORIA SUBACIDA (Peck) Sacc.

Among the larger resupinate species having thin-walled, annual tubes, this species described by Peck in 1885 is very common as well as very conspicuous. I have collected it in many forms, in many localities, and on many different hosts, both coniferous and

deciduous. My notes refer to it in the fresh state as "milk-white all over, rather soft," "cream-colored," "fairly soft when fresh and not so yellow," etc.

Both the margin and the hymenium vary from white to yellowish according to age and position on the substratum. There are also thin, tuberculose, vesiculose, and other forms presenting unusual variety in appearance so that it is no wonder that much confusion has arisen regarding the limitations of the species and its relationship. According to Overholts, who has examined the types since I have, the spores are oblong-ellipsoid or ovoid, $4.5–6 \times 2.5–3.5\ \mu$, and there are variable cystidia-like structures among the basidia. I have never noticed any prominent subacid odor.

The following named hosts are represented in our herbarium: pine, spruce, Douglas spruce, hemlock, fir, cedar, oak, maple, birch, cherry, and butternut.

Most of the specific names for this plant were published about the same time. The name in common use is retained until a fair degree of certainty can be reached regarding two or more doubtful species. I have a specimen which I collected at Lake Placid in October, 1912, on the underside of a coniferous log, which shows the depressed spots described for *P. ornatus,* but I hesitate at this time to displace *P. acida* simply on page priority without a little more evidence.

Poria subacida (Peck) Sacc. Syll. Fung. **6**: 325. 1888

?*Polyporus induratus* Peck, Ann. Rep. N. Y. State Mus. **31**: 37. 1879. *Myriadoporus induratus* Peck, Bull. Torrey Club **11**: 27. 1884.

?*Polyporus ornatus* Peck, Ann. Rep. N. Y. State Mus. **38**: 92. 1885.

Polyporus subacidus Peck, Ann. Rep. N. Y. State Mus. **38**: 92. 1885.

Poria Beaumontill Berk. & Curt.; Cooke, Grevillea **15**: 26. 1886.

Poria omoema Berk.; Cooke, Grevillea **15**: 26. 1886.

Poria subaurantia Berk.; Cooke, Grevillea **15**: 27. 1886.

Peck's species were described from New York and the others

from South Carolina and Alabama. The following specimens have been examined in the herbarium here:

Ellis, N. Am. Fungi *314*; Ellis & Ev. N. Am. Fungi *2803*; Rav. Fungi Am. *107*; Rav. Fungi Car. *20*; Labrador, *Turner;* Canada, *Dearness, Macoun 36, 99, 104, 213, 321, 409, 557*; Maine, *Murrill 2166, 2521, 2522, 2525, P. Wilson;* Vermont, *Burt;* New Hampshire, *Underwood & Cook, P. Wilson;* New York, *Atkinson (Cornell Univ. Herb. 4664a, 8272), Burnham 9, 10, Jackson (Cornell Univ. Herb. 18667), Murrill 597, 833, Smith (Cornell Univ. Herb. 8231), Underwood, P. Wilson;* New Jersey, *Ellis;* Pennsylvania, *Gentry, Sumstine 11, 12, 22*; Virginia, *Long 3778, Murrill 260*; West Virginia, *Ellis 11*; Ohio, *Mòrgan 334, 575*; Indiana, *Underwood;* Missouri, *Schrenk 8*; Arkansas, *Long 19812*; Kansas, *Bartholomew 1315*; New Mexico, *Long 3759*; Colorado, *Bethel 433*; North Carolina, *Memminger;* South Carolina, *Ravenel;* Alabama, *Earle;* Louisiana, *Langlois 2428, 2431*; Florida, *Calkins 69, 532, 533, 806*; Costa Rica, *Maxon 589*.

4. PORIA GRISEOALBA (Peck) Sacc. Syll. Fung. **6**: 306. 1888

Polyporus griseoalbus Peck, Ann. Rep. N. Y. State Mus. **38**: 91. 1885.

Described as follows from specimens collected by Peck at Osceola, New York, in July:

"Effused, thin, tender, adnate, uneven, scarcely margined, indeterminate, grayish-white, with a thin pulverulent subiculum; pores very minute, subrotund, often oblique.

"The pores are sometimes collected in little heaps or tubercles as in *P. molluscus* and *P. Vaillantii.* In the dried state they are slightly tinged with creamy yellow."

The single collection at Albany is said to be rather scant, with extremely thin fructification. Overholts reports the spores to be oblong or short-cylindric, sometimes curved, often pointed at the base, $4–5 \times 1–2\,\mu$. I have not had an opportunity to study the types.

5. PORIA CINEREA (Schw.) Cooke, Grevillea **14**: 111. 1886

Polyporus cinereus Schw. Trans. Amer. Phil. Soc. **4**: 159. 1832.

Described as follows by Schweinitz, who found it frequent on

dead branches of *Liriodendron* and *Juglans* at Bethlehem, Pennsylvania:

"P. longissime effusus, angustatus, albo-marginatus et effiguratus, margine tenui subfimbriato nec tamen byssino. Tubis obliquis brevioribus, poris angustis, subflexuosis. Longitudine 4–6 unciali, ½–1 unciali latitudine. Totus unicolor, eleganter cinereus."

There are no types, either at Philadelphia or at Kew, and no one can say just what Schweinitz included under this name. Morgan reports the species from Ohio and his specimens are preserved (See *P. Caryae*). Ellis was probably influenced by Morgan when he published his exsiccati. It is just possible, though not probable, that *P. cinerea* and *P. Caryae* are synonyms, but there is no way to prove it.

6. PORIA CARYAE (Schw.) Cooke, Grevillea 14: 111. 1886

Polyporus Caryae Schw. Trans. Amer. Phil. Soc. 4: 159. 1832.

Schweinitz found this species spreading a foot or more over a fallen trunk of *Carya alba* at Nazareth, Pennsylvania. His description—an unusually long one for him—is as follows:

"P. junior tuberculoso-elevatus, interruptus, substantia spongiosa-tomentosa, margine sterili saepe tumido. Demum late effusus, magis aequabilis et subindurescens, margine tunc tenuissimo, submembranaceo, candido, praeditus. Tubis brevibus, parietibus crassiusculis, poris minoribus subrotundis et subflexuosis; interdum regulariter effusis, interdum pulvinatim in tuberculos elevatis. Ex fuliginis cinerascit. Ad pedalem longitudinem sub trunco effusus."

Fortunately, portions of the type are preserved, both at Philadelphia and at Kew, and they appear to match up perfectly with what Morgan called *P. cinereus* Schw. and described as follows:

"Widely effused, adnate, firm; the border narrow, thin, white-fimbriate. Pores small, unequal, subrotund, obtuse, cinereous.

"In woods on the lower side of old logs; common. The whole of a uniform ashen hue except the minute whitish fringe of the border. The growing specimens are somewhat moist, but they shrink little in drying and become quite firm. The pores measure about .20 mm. in diameter. It is an elegant species."

A fine Ohio specimen sent by Morgan to Underwood in 1894 is apparently attached to a portion of a young oak log with the bark still on it. It is now uniformly avellaneous except at the very narrow margin, which is whitish. In the same year, Underwood collected the species at Fern, Putnam Co., Indiana, but never named it.

The specimens issued by Ellis and Everhart as *Poria cinerea* in N. Am. Fungi *2306* were collected by Calkins in Florida, near Jacksonville. They mention No. *440* as a synonym, distributed as *P. argillacea* Cooke. There is a separate specimen so named in the Ellis Collection collected on rotten wood near Philadelphia in November, 1885, by Gentry.

Specimens collected by me (No. *2517*) near Willimantic, Maine, in September, 1905, grew on a dead beech log. They were white with a slight cinereous cast when fresh, and are now avellaneous like those of Morgan.

Caloporus expallescens P. Karst., described from Finland, on birch wood, somewhat resembles this species. Its hymenium is primordial and difficult to compare.

7. PORIA ARGILLACEA (Cooke) Sacc. Syll. Fung. 6: 321. 1888

Polyporus argillaceus Cooke, Grevillea 7: 1. 1878.

The type collection was made by Harkness on rotting oak wood in the Sierra Nevada, California, at an altitude of 2,500 feet. A specimen from Harkness in the Ellis Collection was collected on rotten logs of oak at Colfax, which agrees with the Harkness Catalogue. Cooke had two numbers from Harkness, *958* and *1000*, one on oak and the other on *Pinus Lambertiana*. I have seen both at Kew and my notes read: "The one on pine is probably different. Leave it out." As the oak is mentioned first, the specimen growing on it would be the type.

8. **Poria umbrinescens** sp. nov.

Irregularly effused, not always continuous, inseparable, thin, 5 cm. or more broad; margin conspicuous, broad, thin, delicate, sterile, white to slightly yellowish-discolored, consisting of minute, spreading, interwoven mycelial threads; context scarcely

differing from the margin, sometimes almost disappearing with age; hymenium uneven, owing to the inequalities of the substratum, white to yellowish or dirty-white, umbrinous in old and dried specimens; tubes oblique, appearing in patches, at first short, angular, thin-walled, irregular in shape and size, 2–3 to a mm., becoming 3 mm. in length, with long, lacerate dissepiments, soon discoloring, weathering, and falling away with age; spores copious, subglobose to ovoid, smooth, pale-umbrinous under the microscope, 4–6 μ long; cystidia none.

Type collected on a wet palm stump at Constant Spring Hotel, near Kingston, Jamaica, December 13, 1908, *W. A. & Edna L. Murrill 41*. It is rather surprising to find dark-colored spores on a plant of this character, but this accounts for the tubes becoming umbrinous with age.

9. **Poria lacticolor** sp. nov.

Irregularly effused for several centimeters, becoming continuous, inseparable, very thin; margin conspicuous, pure-white, unchanging, very thin, delicate; context white, a mere membrane; humenium even, pure-white, unchanging with age or on drying; tubes oblique, angular, thin-walled, short, 4 to a mm., concolorous within, with long, toothed dissepiments; spores not found.

Type collected on a dead log in a virgin forest at Ciego de Avila, Puerto Principe Province, Cuba, March 21, 1905, *F. S. Earle & W. A. Murrill 636*. Also collected on rotten wood at Belmont, St. George's, Grenada, September 22, 1095, *Broadway*. This species somewhat resembles a coating of whitewash with fine lines in it made by the brush.

10. **Poria niveicolor** sp. nov.

Occurring in small, irregular patches about 3 cm. in diameter, inseparable, thin; margin conspicuous, thin, pure-white, cottony, rarely connected with rhizomorphic strands, becoming somewhat elevated with age or on drying; context thin, white, similar to the margin; hymenium quite even, becoming continuous, snow-white when fresh, with a very faint rosy-avellaneous tint in dried specimens; tubes very short, regular, angular, thin-walled, entire, 5 to a mm.; spores hyaline.

Type collected on well-rotted wood in Troy and Tyre, Cockpit

Country, Jamaica, January 12–14, 1909, *W. A. Murrill & W. Harris 1056.*

11. **Poria cremeicolor** sp. nov.

Broadly effused for many centimeters over the smooth surface of the substratum, continuous, inseparable, thin; margin conspicuous, indefinite, very thin, cremeous; context like the margin, a mere membrane; hymenium even, not glistening, uniformly cremeous, becoming very slightly darker in dried specimens; tubes regular, rounded to somewhat angular, firm, becoming thin-walled but remaining entire, less than 0.3 mm. long, 5 to a mm.; spores hyaline.

Type collected on small, hard, decorticated hardwood stems in Troy and Tyre, Cockpit Country, Jamaica, January 12–14, 1909, *W. A. Murrill & W. Harris 863.*

12. **Poria adpressa** sp. nov.

Irregularly effused for many centimeters over decorticated wood, inseparable, thin, following closely the inequalities of the surface and also occupying the crevices and depressions; margin conspicuous, thin, white to slightly yellowish, closely appressed; context thin, white; hymenium appearing in patches and then becoming fairly continuous, uneven, not glistening; tubes very oblique, arranged as in oblique-tubed forms of *Coriolellus sepium* but much smaller, about 4 to a mm., larger by confluence, firm, rather thick-walled, entire on the edges; spores hyaline.

Type collected on well-rotted, decorticated wood at Rio Gavelan, Province of Santa Clara, Cuba, March 26, 1910, *Britton, Earle & Wilson 6033.* This species has the habit of *Coriolellus sepium* when growing resupinately on an upright trunk or stump, but the tubes are minute and there is no tendency to form a pileus. Young specimens collected on corticated wood in Cuba (*Earle & Murrill 167*) and in St. John (*Raunkiaer 204*) appear to have the same kind of hymenium, but its color is slightly rosy-avellaneous, which leaves the identity of these specimens in doubt.

13. **Poria tenuipora** sp. nov.

Effused for many centimeters, covering large areas, continuous, inseparable, thin; margin cottony, pure-white even in dried

plants, inconspicuous, scarcely visible in age; context white, too thin to measure, being a mere membrane holding the tubes together; hymenium quite even, white, cremeous where bruised, with a slight rosy-avellaneous tint in dried specimens; tubes rather rigid, oblique, regular in shape and size, reaching 1 mm. in length, concolorous within, thin-walled, the mouths rounded, entire, exceedingly minute, 10 to a mm.; spores minute, hyaline.

Type collected on much-decayed wood in Troy and Tyre, Cockpit Country, Jamaica, January 12–14, 1909, *W. A. Murrill & W. Harris 855*. Also collected on a standing rotten stub in woods at Mooretown, Jamaica, November 22, 1902, *F. S. Earle 541*; and on rotten wood in the forest at Alto Cedro, Cuba, March 19–20, 1905, *F. S. Earle & W. A. Murrill 548*.

14. **Poria Earlei** sp. nov.

Widely effused, continuous, inseparable, about 4 mm. thick; margin inconspicuous, delicate, pure-white, scarcely apparent in older specimens; context white, practically disappearing with age; hymenium even, regular, glistening, milk-white, becoming very faintly yellowish in dried specimens; tubes angular, quite regular, white within, very thin-walled, entire to somewhat toothed, 4 mm. long, 5–7 to a mm.; spores scanty, ellipsoid, rather blunt at the ends, smooth, hyaline, $5 \times 3.5\,\mu$.

Type collected on a rotten log on Rose Hill, Jamaica, 4,000 feet elevation, October 30, 1902, *F. S. Earle 297*. This species has longer and larger tubes than *P. tenuipora,* and they glisten distinctly when turned from side to side in the light.

15. **Poria corioliformis** sp. nov.

Irregularly effused over fallen leaves and the surface of decayed twigs in continuous areas 1–2 cm. wide, inseparable, not very thin, following to some extent the irregularities of the substratum; margin conspicuous, broad, finely tomentose, white to cremeous, elevated at times as though about to project as a narrow pileus; context similar to the margin and quite conspicuous; hymenium somewhat uneven, cremeous, glistening; tubes quite regular, rounded to somewhat angular, 1–1.5 mm. long, cremeous within, rather firm and thick-walled for the genus, entire on the edges, 4–5 to a mm.; spores subglobose, smooth, hyaline, $4\,\mu$.

Type collected on fallen leaves and twigs in woods along the river at San Antonio, Cuba, April 20, 1903, *J. A. Shafer 253*. This may be a resupinate form of an undescribed species of *Coriolus,* closely related to *C. depauperatus,* but with smaller tubes.

16. **Poria regularis** sp. nov.

Forming small, rather thin patches 2 cm. or less wide, which are continuous as far as they go and do not readily separate from the substratum; margin a thin membrane of white mycelium connected with rhizomorphic strands and apparently disappearing entirely with age, leaving simply a mass of tubes; context thin, white, not apparent in age; hymenium very even and uniform, not glistening, milk-white, unchanging; tubes regular, angular, thin-walled, entire, reaching 0.5 mm. in length, 4–5 to a mm.; spores hyaline.

Type collected on a fallen, dead, corticated branch of some hardwood tree at Morce's Gap, Jamaica, a very wet locality 5,000 feet above sea-level, December 29, 30, January 2, 1908–9, *W. A. & Edna L. Murrill 703*. The abundance of moisture present probably had something to do with the unusual form of the hymenophore.

17. **Poria polyporicola** sp. nov.

Effused almost continuously for many centimeters over the hymenium of an old polypore, inseparable, very thin; margin pure-white, exceedingly thin, diffuse, becoming discolored with age; context not apparent; hymenium closely applied to the tubes of the polypore, regular, even, white to pale-avellaneous-umbrinous; tubes exceedingly shallow, thin-walled, entire, rounded to angular, white to slightly yellowish, 4–5 to a mm.; spores hyaline.

Type collected on an old hymenophore of *Pogonomyces hydnoides* growing on a cypress log near Fort Myers, Florida, February 29, 1916, *Paul C. Standley 12895*. Among the tubes are numerous sporophores of a minute brown species of *Orbilia,* which apparently has something to do with their discoloration.

18. **Poria cinereicolor** sp. nov.

Effused for several centimeters over the surface and hymenium of an old polypore, continuous, inseparable, very thin; margin

like a delicate gray cobweb on which the tubes appear in patches and then become continuous, when the mycelium and context practically disappear; hymenium ash-colored, unchanging, very even, regular, not glistening; tubes very short, rounded to angular, entire, rather thick-walled at first, 7–8 to a mm.; spores hyaline.

Type collected on both the upper and lower surfaces on an old specimen of *Ganoderma* in Castleton Gardens, Jamaica, December 14, 1908, *W. A. & Edna L. Murrill 63*. This species forms a very striking contrast with its mahogany-colored host.

19. **Poria subavellanea** sp. nov.

Effused in rather thin patches 3–5 cm. or more long on the underside of corticated or decorticated pine logs; margin conspicuous, pure-white, unchanging, cottony, thin, sometimes elevated, with a tendency to separate from the substratum; context thin, white, hardly apparent in age; hymenium uneven, continuous, glistening, pale-avellaneous; tubes firm, thin-walled, entire, angular, 1–2 mm. long, 4 to a mm.; spores very scanty, ovoid, smooth, hyaline, about 4 μ long.

Type collected on pine bark at Auburn, Alabama, November 20, 1897, *F. S. Earle 121*. Also collected on a decorticated log of *Pinus echinata* near Womble, Arkansas, November 6, 1915, *W. H. Long 19811*. This species might be a resupinate form of some undescribed species of *Coriolus*.

20. **Poria subcorticola** sp. nov.

Effused for several centimeters, thin, inseparable, continuous; margin conspicuous, rather thick, persistent, white to cream-colored; context similar to the margin, persistent, apparent as a paper-thin membrane; hymenium even, white to cream-colored, not glistening, appearing in patches and finally becoming continuous; tubes mostly primordial, very shallow, angular, rather thick-walled, entire, 4–5 to a mm.; spores hyaline.

Type collected on much-decayed decorticated wood at Cuernavaca, Mexico, December 24–27, 1909, *W. A. & Edna L. Murrill 363*. Also collected on the underside of an old fruit-body of *Coriolopsis fulvocinerea* at Colima, Mexico, January 3–4, 1910, *W. A. & Edna L. Murrill 584*. The hymenium resembles that of *Poria corticola.*

21. PORIA VULGARIS (Fries) Cooke, Grevillea 14: 109. 1886

Polyporus vulgaris Fries, Syst. Myc. 1: 381. 1821.

Fries found this species very common throughout the entire year on fallen wood of pine and other trees, as well as upon leaves. He describes it as follows:

"Longe effusus, tenuis, siccus, laevis, albus, poris exiguis aequalibus.

"Ad longitudinem usque pedalem effusus, laevis, ½ lin. crassus, detritus immutabilis, nec nisi in frustulis a ligno separabilis; margine praecipue junioris tenuissime pubescente. Pori recti vel obliqui, subrotundi."

In Saccardo's "Sylloge" it is reported on the wood of various hardwood trees and conifers from widely separated temperate and tropical regions. Bresadola discusses the species at length in his paper on fungi collected in Hungary and finds it difficult because it is so frequently sterile. He states that *Polyporus luteoalbus* P. Karst., occurring on fir wood and always sterile, is *P. vulgaris* Fries of the "Systema"; and that *forma calcea* of Fries is also sterile. The typical form, according to him, occurs on the wood of frondose trees and is always fertile, the spores being obovoid, hyaline, $3.5–4 \times 2–2.5\ \mu$. I have good specimens from him of this form and can match them fairly well with American material, although the species cannot by any means be called *common* with us.

I have seen the specimens in the Fries Herbarium, which are not very satisfactory, and have one sent by him to Massee, which agrees for the most part with those from Bresadola. If we accept Bresadola's interpretation, we have a species with regular, glistening tubes, which are smaller and usually shorter than those of *P. subacida* and do not become so yellow with age or on drying. From *P. vaporaria,* it differs decidedly in microscopic characters and the tubes are easily distinguished. *P. mollusca* is much softer and yellower, although Fries included it as his variety *lutescens.*

The following specimens, mostly European, have been examined in the herbarium here. A good hunt would doubtless bring more to light.

Romell, Fungi Scand. *16;* Sydow, Myc. Mar. *2201, 2814, 3422;* Thüm. Myc. Univ. *1503;* Wart. & Wint. Schweiz. Krypt. *719;* Sweden, *Fries;* Finland, *Karsten;* England, *Plowright;* Hungary, *Kmet;* New Jersey, *Ellis 348;* Pennsylvania, *Murrill 1094*; West Virginia, *Nuttall 909*.

22. **Poria Amesii** sp. nov.

Effused for several centimeters, continuous, inseparable, 2–5 mm. thick; margin narrow, white, unchanging, at first cottony, fimbriate, and appressed, becoming membranous and elevated, rarely slightly reflexed; context very thin but visible under a lens as a gelatin-like membrane quite distinct in color from the milk-white tubes; hymenium even, continuous, glistening, white, unchanging, having normal tubes in places and elsewhere being entirely cellular and abnormal; tubes, when normal, very delicate, thin-walled, angular, subentire, 2–3 mm. long, 5–6 to a mm.; spores very abundant, ovoid, smooth, hyaline, $3 \times 2\,\mu$.

Type collected on decorticated or burnt maple wood and on the hymenophores of another species of *Poria* at Valley Stream, Long Island, *Frank H. Ames 340*. These specimens were sent to me by Mr. Ames without date of collection shortly before his death.

23. **Poria subcollapsa** sp. nov.

Effused for several centimeters, covering small or large areas according to conditions, usually continuous, inseparable, thin; margin ordinarily very delicate, whitish, soon becoming inconspicuous, but at times rather broad and persistent; context similar to the margin, inconspicuous; hymenium not glistening, white and even when young, becoming pale-rosy-avellaneous and irregular, owing to the formation of many larger openings by the confluence of the pores; tubes oblique, rounded to angular, thin-walled, 4–5 to a mm., with slightly elongate, delicate dissepiments, which collapse to some extent with age; spores hyaline.

Type collected on a fallen dead stick at Rose Hill, Jamaica, October 24, 1902, *F. S. Earle 68*. Also collected on banana trash at Rio Piedras, Porto Rico, February, 1914, *J. A. Stevenson 1465*.

24. **Poria monticola** sp. nov.

Effused over large areas, continuous, inseparable, 1–3 mm. thick; margin thin, appressed, fimbriate to membranous, usually

narrow and practically disappearing with age, but at times rather thick and felty, reaching 5 mm. broad; context very thin, white, inconspicuous with age; hymenium very even, continuous, glistening, white or tinged with yellow, often showing brownish stains in dried specimens where touched with the fingers or near the margin where the tubes are young; tubes annual, large, rigid, 1–3 mm. long, rounded or somewhat angular, entire, 2–3 to a mm.; spores copious, narrowly-ellipsoid, often slightly curved and apiculate at the base, smooth, hyaline, $5\text{–}6 \times 3\,\mu$.

Type collected on a decorticated log of *Pinus monticola* at Priest River, Idaho, *J. R. Weir 61*. Also on the same host in the same locality, *J. R. Weir 57, 72, 77;* on dead wood of *Pinus monticola* at Agassiz, British Columbia, *J. R. Weir 65;* and on dead wood of *Picea Engelmanni,* probably from Priest River, Idaho, *J. R. Weir 63*. All of these specimens are very uniform in appearance and represent the species in excellent fashion.

25. **Poria lacerata** sp. nov.

Effused for several centimeters, continuous, inseparable, thin; margin cottony or felty, appressed, milk-white, unchanging, narrow, practically disappearing with age; context a mere white membrane; hymenium even, continuous, milk-white, staining yellowish-brown where bruised in handling; tubes rather long, delicate, thin-walled, angular, becoming fimbriate-lacerate at maturity, 2 mm. long, about 3 to a mm.; spores copious, ellipsoid, smooth, hyaline, usually uniguttulate, $6 \times 3.5\,\mu$.

Type collected on a well-rotted, decorticated log of *Quercus alba* near Womble, Arkansas, November 7, 1915, *W. H. Long 19777*. Described from a good specimen sent me by Professor Long, who refers to another number collected by him which I have not seen.

26. **Poria rimosa** sp. nov.

Effused for a few centimeters but interrupted by the irregularities of the substratum, inseparable, thin; margin very thin, membranous, milk-white and unchanging in the early stages, becoming cremeous and more felty when older, always appressed; context white, inconspicuous in age; hymenium appearing in patches, at length continuous, but soon cracking transversely every few millimeters, white with a cremeous tint to dull-cremeous; tubes about 1 mm. long, oblique, thin-walled, angular, entire,

4 to a mm.; spores scarce, narrowly-ovoid, smooth, hyaline, $5 \times 2.5\,\mu$.

Type collected on a well-rotted, decorticated log of *Juniperus monosperma* near the Gila National Forest, New Mexico, October 23, 1911, *W. H. Long & G. G. Hedgcock*. This is said by the collectors to be common, but I have only this one packet, which is without a number.

27. **Poria heteromorpha** sp. nov.

Effused for many centimeters, continuous, usually separable because the substratum is much decayed, quite thick; margin conspicuous, thin, cottony, white, becoming fulvous with age; context thin, similar to the margin; hymenium uneven, continuous, white when young, ochraceous or fulvous with age, usually reviving; tubes large, thin-walled, entire, somewhat collapsing, 1–2 mm. long, 2 to a mm., becoming much elongated with age in oblique positions, the long undulate dissepiments resembling lamellae; spores copious, subglobose to broadly ovoid, uniguttulate, smooth, hyaline, 3–4 μ long, 5 μ in the Florida specimens.

Type collected on very rotten wood in Troy and Tyre, Cockpit Country, Jamaica, January 12–14, 1909, *W. A. Murrill & W. Harris 857*. Also collected at the same time and place by *W. A. Murrill & W. Harris 865;* on very rotten wood near Port Antonio, Jamaica, December 17, 1908, *W. A. Murrill 188;* on very rotten wood at Rio Piedras, Porto Rico, July 26, 1915, *J. A. Stevenson 2891;* and on dead leaf-stalks of *Sabal Palmetto* near Ocala, Florida, August 11, 1913, *W. H. Long 12360*.

This is a species of very unusual appearance, with a hymenium varying from poroid to somewhat daedaleoid and reminding one of *Lenzites heteromorpha*. It likes wood almost reduced to humus and can be stripped off in large flakes, which are soft, flexible, and very light in weight. After the old hymenophores are discolored and appear dead, patches of fresh white tubes will arise from portions of the hymenial surface. This frequently happens, however, with annuals in tropical countries and may be due to the recurrence of rains.

NEW YORK BOTANICAL GARDEN.

NOTES ON NORTH AMERICAN HYPOCREALES—IV. ASCHERSONIA AND HYPOCRELLA

F. J. Seaver

(With Plate 6)

The perfect stage of *Aschersonia turbinata* was recently described by Dr. Roland Thaxter,[1] but the generic position of the fungus was left an open question. In that paper Dr. Thaxter states that so far as he knows no ascosporic condition has previously been observed in any of the group (*Aschersoniae*). After a study of the tropical material and literature at hand, the writer is convinced that this apparent failure to detect the perfect stage of this genus is due not so much to its absence as to the fact that whenever the perfect stage is found, the fungus is at once and quite properly referred to some other genus, to *Hypocrea* by early writers and to *Hypocrella* by more recent ones. In fact there seems to be little more reason for describing the perfect stage of this fungus under the name of *Aschersonia* than for describing a *Cordyceps* under the name of *Isaria*, although the *Isaria* stage is usually mentioned when it is known. That the connection between *Aschersonia* and *Hypocrella* has been observed and noted in literature will be pointed out later on.

The attention of the writer was first called to this matter several years ago while attempting to determine a collection of tropical fungi. One specimen collected by A. A. Heller in Porto Rico in 1900 was found to have linear spores and was labeled *Hypocrella* sp. and filed away under the new and noteworthy species of Hypocreales, since it had been overlooked in the work on the Hypocreales of North America. The same species was collected by Dr. B. Fink in Porto Rico in 1915 and doubtfully referred to *Hypocrella filicina* Rehm, although the stroma is white instead of

[1] Bot. Gaz. 57: 308–313. 1914.

black as described by Rehm. The blackening might easily be due to age and weathering. Many other tropical specimens have been studied which are apparently the same but in which the perfect stage is lacking. These have been referred to *Aschersonia*.

Recently, since taking up a study of Porto Rican fungi, these facts have again forced themselves to the front and more attention has been given to the matter. In looking over the literature of the subject I find that *Hypocrea phyllogena* Mont.[2] which was doubtfully recorded for North America in *North American Flora* has every appearance of being the perfect stage of an *Aschersonia* as recently described by Thaxter. The capitate apex of the ascus which is characteristic of the perfect stage of *Aschersonia* is especially evident in Montagne's illustration. When several years after the description of *Hypocrea phyllogena*, Montagne founded the genus *Aschersonia*,[3] it was said to be related to *Hypocrea* (which at that time included *Hypocrella*) and was described as representing the *Hypocreae* in which the asci are wanting, or what is now known as the pycnidial stage of the *Hypocreae*. It is even not unlikely that the type of *Aschersonia*, *Aschersonia tahitensis* Mont., is the pycnidial stage of his own *Hypocrea phyllogena*.

From the above facts and the observations which have been made on the tropical specimens in the collections of the garden, it seems evident that the genus *Aschersonia* represents the pycnidial form of *Hypocrella* and that *Hypocrella phyllogena* (Mont.) Speg. which was described eight years before the genus *Aschersonia* was proposed really represented the perfect stage of an *Aschersonia* as now known. *Aschersonia* would then occupy the same relation to *Hypocrella* as *Isaria* to *Cordyceps*.

In looking over the literature of the subject I find that this connection has not been entirely overlooked by previous authors. In 1900, Raciborski[4] gave a detailed description of *Hypocrella discoidea* (Berk. & Br.) Sacc. (the type of the genus *Hypocrella*). This was reported by him on *Elettaria* and *Amomum*. In a note

[2] Ann. Sci. Nat. II. 13: 340. 1840.

[3] Ann. Sci. Nat. III. 10: 121. 1848.

[4] Parasit. Algen und Pilze Java's 3: 22–23. 1900.

on this species he refers to a snow-white, otherwise similar species of *Hypocrella* (?) which grows abundantly on *Elettaria* stems. In this form, however, he says that only the conidial form (*Aschersonia*) has been found by him. In 1909 von Höhnel[5] described *Hypocrella cretacea* and calls attention to the fact that this probably represents the perfect stage of the *Aschersonia* mentioned by Raciborski in the article referred to above. It should not be overlooked that Raciborski has noted the similarity in habitat and all external characters except color to *Hypocrella discoidea,* the type of the genus *Hypocrella* so that we at least have reason to suspect that the genus *Hypocrella* itself was founded on the perfect stage of an *Aschersonia. Hypocrella cretacea* von Höhnel may be found to be identical with *Hypocrella discoidea* (Berk. & Br.) Sacc. as described by Raciborski.

In the absence of suitable material it is difficult to determine the identity of our own species with any degree of certainty. The one collected by Heller agrees well with *Hypocrella cretacea* von Höhnel, as collected by von Höhnel and distributed by Rehm in his Ascomycetes *1870*. As already mentioned this may prove to be identical with *Hypocrella discoidea* (Berk. & Br.) Sacc. to which it is said to be similar, although Raciborski claims that the latter species differs from other species of *Hypocrella* in the fact that the spores do not break up into segments. This apparent difference may be due to the age of the specimens and may not prove to be of specific value although considerable importance has been attached to it. Just how *Hypocrella discoidea* differs from *Hypocrella phyllogena* (Mont.) Speg. it is impossible to know in the absence of authentic material of the latter species.

It is difficult to find conidia in the mature stromata. In most specimens, however, the younger stromata show an abundance of conidia. As these are usually found loose in large numbers, their method of attachment is not easily detected. The individual conidia appear to be rather small, ellipsoid bodies which taper into a bristle-like apiculus at each end. Although they are guttulate and granular and sometimes pseudoseptate, no true septum could be detected. In the absence of asci, the presence of this par-

[5] Sitz.-ber. Akad. Wissen. Wien. 118: 311. 1909.

ticular type of conidia together with the white discoid stromata are regarded as of specific importance, although the conidia could not be found in the authentic specimen of *Hypocrella cretacea* examined, all of the stromata in which were ascigerous.

In looking over our collections, nine specimens collected by H. H. Whetzel and E. W. Olive (Nos. *716–724* inclusive) are found to represent the conidial stage of what is here referred to as *Hypocrella cretacea*. All so far as examined show the typical stromata and conidia but none so far as discovered contain asci. All are reported on some species of *Adiantum*. The same form was collected by F. L. Stevens on fern. The specimen collected by B. Fink which shows both asci and conidia has already been mentioned. An abundance of the conidial stage of the fungus was collected by N. L. Britton, J. F. Cowell and Stewardson Brown (No. *5250*), also, on some fern. While the species appears to be more common on ferns, what appears to be the same species was collected by L. M. Underwood and F. S. Earle in Cuba on the leaves of some flowering plant. Since the fungus is entomogenous, it would naturally be dependent on the insect host rather than the plant host. The latter however might be restricted in its occurrence to certain plant hosts. This is one of the questions which needs careful investigation.

If our conclusions are right regarding the connection of *Aschersonia* and *Hypocrella*, the form for which Thaxter recently described the ascigerous stage, assuming that this is specifically distinct, as it appears to be, would be a *Hypocrella*. It should then become **Hypocrella turbinata** (Berk.) comb. nov.

Another very interesting form with its ascigerous stage has been encountered in our collections distributed by Sydow in Fungi Exotici Exsiccati *84*, under the name of *Hypocrella salaccensis* (Racib.) Petch (in litt.). The specimen examined was collected in the Philipines by P. W. Graff. This species was originally described by Raciborski under the name of *Barya salaccensis*.[6] In this species, according to its author, the spindle-shaped conidia are formed after the fashion of an *Aschersonia*. These are followed by the perithecia which are so prominent that they appear

[6] Bull. Acad. Sci. Cracovie 1906: 909.

almost superficial. The capitate ascus is a very conspicuous character in this species and the segmentation of the spores is much more conspicuous than in the previous species.

Another species with its perfect stage was collected by J. R. Johnston and J. A. Stevenson at Naguabo, Porto Rico, March 9, 1914, No. *1640*. This species is said by the collectors to occur on white fly and was collected on the leaves of *Bignonia unguis* L. In this species, which will be here designated as **Hypocrella disjuncta** sp. nov., the stromata are tuberculate and slightly constricted at the base. They are perched on the rather large ellipsoid scale so that the insect itself is distinctly visible, serving as a substratum for the stroma. The stroma becomes dull-grayish when mature. The capitate apex of the ascus is small since the ascus itself is constricted at the apex and strongly swollen near the center. While the spores are evidently filiform when young, they very soon break up into their component parts, which become so disjuncted and disheveled that the older ascus appears to be polysporous with little hint of their real filiform character. This is very different from *Hypocrella cretacea* in which the filiform spores may be easily seen protruding from the broken ascus.

Still another Porto Rican species was collected by H. H. Whetzel and E. W. Olive at Maricao on the leaves of *Inga laurina* Willd., No. 734. This was labeled *Aschersonia* sp. Later, on a more careful examination, some of the stromata were found to contain asci and the species was referred to *Hypocrella guaranitica* Speg., since it seems to agree well with that species as distributed by Balansa in Plantes du Paraguay, No. *3146*. The stromata in this species are tubercular, rather conspicuous and become black at maturity. The species grows on a circular scale which is almost completely obscured at maturity.

Hypocrella Tamoneae Earle, which was published by the writer in the "Hypocreales of North America," was again collected by H. H. Whetzel and E. W. Olive at Maricao, No. *472*. This was said by the collectors to occur on scale insects (?). While this species has all of the characters of a *Hypocrella* its entomogenous character is much less evident than in the other species studied, although as noted above its entomogenous character was sus-

pected by the collectors before its identity was known. The stromata seems to be more firmly attached to the leaf than those of the other species studied. It appears to occur on some kind of an insect spot.

In 1891, Patouillard[7] called attention to the fact that *Hypocrea viridans* Berk. & Curt. is an *Aschersonia.* This species was included in *North American Flora* as a doubtful species. This again emphasizes the similarity between *Hypocrea* (then including *Hypocrella*) and *Aschersonia.*

Since most if not all of the species of *Hypocrella* are entomogenous it may be that the various species of the genus will prove to be of economic importance in combating harmful insects, since two species of *Aschersonia* have already been employed in Florida for this purpose. A critical study of the species of *Hypocrella* in the tropics together with the insects which they parasitize might reveal new insect enemies which could be used for this purpose in our own states. This would at least furnish an interesting field for investigation.

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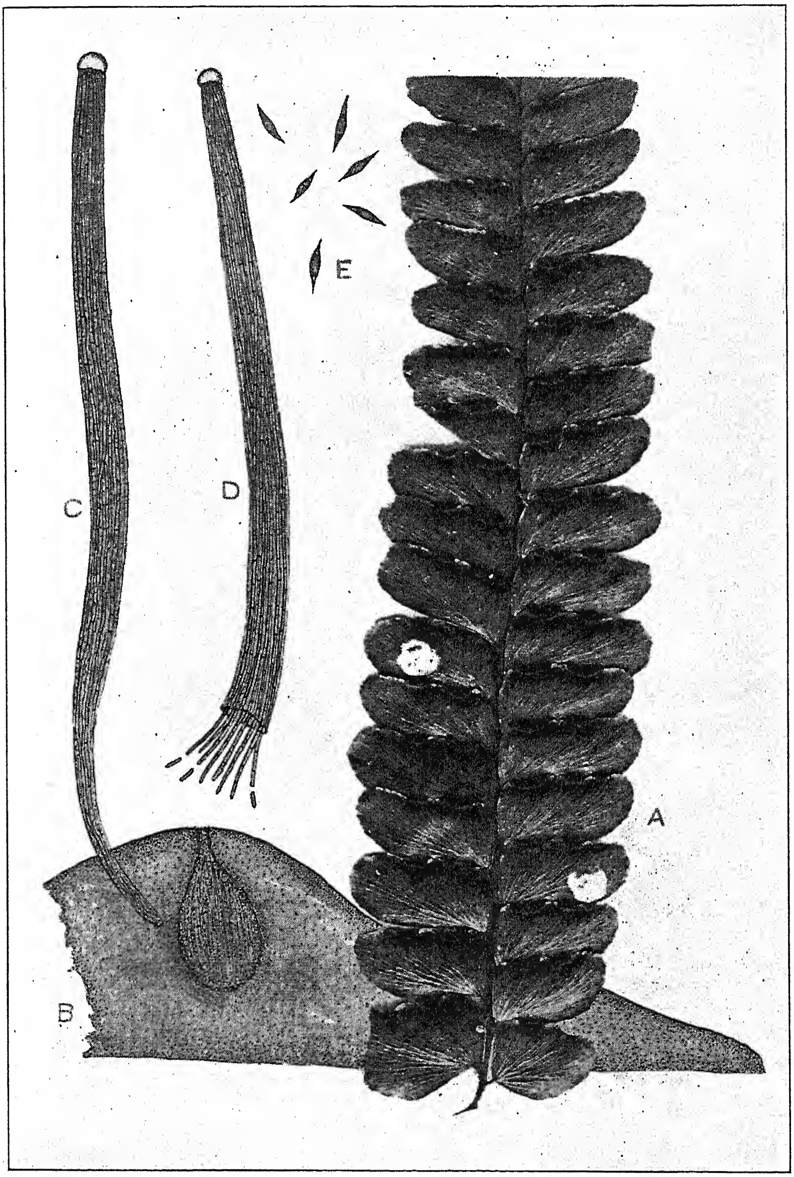
EXPLANATION OF PLATE 6

Hypocrella cretacea.—*A,* photograph of fern leaf with two stromata; *B,* diagram section of stromata showing perithecium; *C,* ascus with spores; *D,* broken ascus with protruding spores; *E,* conidia; *C–E,* drawn with camera lucida.

[7] Bull. Soc. Myc. Fr. 7: 48. 1891.



HYPOCRELLA CRETACEA VON HÖHNEL

TWO NEW TRUFFLES

Helen M. Gilkey

Tuber canaliculatum sp. nov.

Tuber Borchii Kauffman non Vittad. Rep. Mich. Acad. Sci. 12: 216. 1910.

Ascocarp brown, surface conspicuously covered with small, low, polygonal papillae; veins conspicuous, whitish; cortex pseudoparenchymatous with outermost cells sometimes arranged in hyphae more or less parallel with surface of ascocarp, sometimes projecting beyond surface as hairs; pseudaparenchymatous layer changing to somewhat irregularly arranged coalescent hyphae, becoming less connected toward hymenium; thickness of peridium 360–520 μ; venae internae small and inconspicuous to almost wanting, consisting of unconnected somewhat irregularly arranged hyphae, latter 4–6 μ in diam.; tissue between asci of similar structure, but hyphae bordering venae externae becoming distinctly parallel, some ending at margin of vein as more or less regularly arranged, somewhat swollen-tipped paraphyses, others continuing inward to form loose, interwoven tissue filling venae externae; latter much enlarged in places, and hyphal tissue of narrower portions often breaking away, leaving empty channels through ascocarp; asci short-stipitate, semiglobose to cylindric, 72–88 by 96–120 μ, 1-, 2-, or 3- (generally 2-) spored; spores dark-brown, ellipsoid to nearly globose, 40–52 by 48–72 μ, alveolate, 4 by 5 to 7 by 8 alveoli across diameters; sculpturing 4–6 μ thick.

On sandy hillside of maple, oak, and hemlock, bordering a cedar swamp. Allegan Co., Mich., Sept. 15. No. 339, U. C. Coll. *Mrs. C. H. Kauffman.*

This species, which was sent to the University of California herbarium by Professor C. H. Kauffman of the University of Michigan, was published under the name of *T. Borchii* in the 12th Report of the Michigan Academy of Sciences, 1910. The material examined, however, does not have the smooth surface of the latter as described by Vittadini (Mon. Tub., 1831) who

established the species, or by Ed. Fischer (Tuberaceen und Hemiasceen in Rabenhorst, Kryptogamen-Flora von Deutschland. V Abtheilung, 1897); the asci and spores are larger (the measurements for *T. Borchii* given by Fischer being 60–80 by 60–100 μ for asci, and 24–35 by 28–49 μ for spores). The latter measurements made without the sculpturing, may be compared with 28–40 by 36–60 μ, the measurements of the Michigan material made in the same manner. In descriptions of *T. Borchii* no mention is made of the distinguishing characters of the Michigan specimens, *i.e.*, the absence of or very small venae internae, the exceedingly large venae externae sometimes becoming hollow, and the distinct palisade-like hyphae bordering the latter veins. The spore measurements of *T. macrosporum*, given by Fischer are comparable to those of this species (28–45 by 38–80), and the surface of the ascocarp is described as having "kleinen, abgeflacht pyramidenförmigen Warzen oder polygonalen Feldern," but here, also, paraphyses and the peculiar nature of the venae externae are not mentioned, while the reticulation of the spore surface is described—also figured by Tulasne (Fungi Hypogaei, 1851)—as very close, 10 by 15 alveoli occurring across diameters in Tulasne's illustration. The figure and descriptions represent the spore,

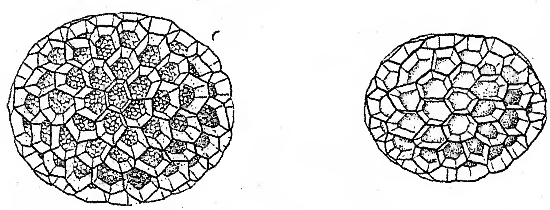


FIG. 1. Spores of the two species described. On the left, one of *Tuber canaliculatum* × 385. On the right, of *Tuber unicolor* × 625.

too, as much longer in comparison to its short diameter than that of the Michigan species.

Tuber unicolor sp. nov.

Ascocarp yellow-brown, 1–2 cm. in diam., somewhat convolute to sometimes deeply furrowed; surface very minutely scabrous; gleba yellowish with slender white veins; outer cortical tissue

coarsely pseudoparenchymatous, breaking away more or less at surface, changing within to irregular open tissue consisting of pseudoparenchyma and hyphae; sub-cortex of similar structure but more compact, and forming origin of venae internae; thickness of peridium 400–600 μ; venae internae similar in structure to sub-cortex, hyphae 4–6 μ in diam.; venae externae conspicuous, long, branching, generally twice the diam. of venae internae, similar in structure to inner cortical layer, hyphae 6 μ in diam.; asci semi-globose, 48–56 by 56–64 μ, 1–4-spored; spores yellow, globose-ellipsoid, 20–38 by 22–40 μ, alveolate, 3 by 4 to 6 by 7 alveoli across diameters, sculpturing 4–5 μ thick.

Beneath the surface of the ground, near oaks. No. 530, U. C. Coll., *L Robba & G. Giavelli.*

Material of this species was received from Dr. Fred J. Seaver, of the New York Botanical Garden, and later from Mrs. Flora Patterson, of Washington, D. C., the material in both cases, however, having been collected near New York City by L. Robba and G. Giavelli.

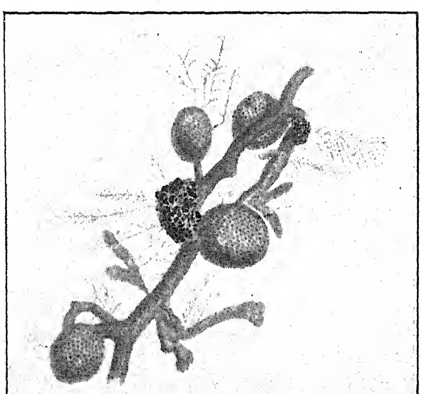
Of the European species of *Tuber* described, this apparently comes nearest *T. dryophilum, T. maculatum,* and *T. rapaeodorum,* principally in the general characters of ascocarp surface and of spore. However, the specimens of this species examined differ from descriptions of all three in the uniform color of the ascocarp, that of the three European species mentioned being described as mottled or spotted. The unusually thick cortex and the 1–4-spored asci also distinguish our species from *T. dryophilum* as described. In gleba color and number of spores in the ascus, it differs from descriptions of *T. maculatum;* and from *T. rapaeodorum* in the usual spore number in the ascus, in the shape of the spores (the measurements cited for the spores of the latter, i.e. 29–42 by 23–29 μ, making them less nearly globose), and in the characteristic structure of the cortex described above, that of the European species as figured by Tulasne (Fung. Hyph., pl 18, fig. 1), having a distinctly pseudoparenchymatous structure without, and hyphal structure within. It is thought best to consider this, therefore, a distinct species.

AGRICULTURAL COLLEGE,
CORVALLIS, OREGON.

A PHYLLACHORELLA PARASITIC ON SARGASSUM

C. Ferdinandsen and Ö. Winge

In March, 1914, Professor C. H. Ostenfeld collected a quantity of Sargassum in the Atlantic at a locality lying at $30^\circ\ 21^1$ N. Lat., $45^\circ\ 20^1$ W. Long. Two of the plants had conspicuous protuberances, which were scattered along the stems and partly on the bladders as well. These protuberances varied in size; being sometimes as large as the head of a pin and sometimes ½–1 cm. across, irregularly rounded and knobby (Fig. 1). The knobby surface of the tumors was due to perithecia-like loculi, sometimes placed close together in a continuous stroma, giving a black color to the tumor; sometimes more scattered, the stroma not being continuous but divided into several minor stromata containing only a single or but few loculi. In the latter case the pale tissue of the host was visible between the small partial stromata.



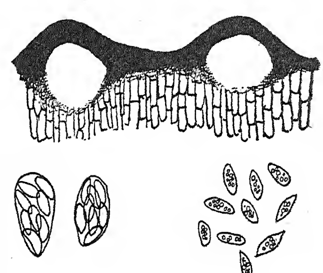


Fig. 1 (On the left). Showing the habit of the fungus, slightly magnified.
Fig. 2. Stroma with two loculi. × 15. Asci and spores. × 160.

A further investigation revealed the fact that the parasitic organism was a well-developed ascomycetous fungus, belonging

to the Dothideales. Its clypeus-like stromata refer it to the Phyllachoraceae[1] (Fig. 2). The curious substratum makes impossible a direct parallel between the position of this fungus in the tissue and that of the Phyllachoraceae, which are parasites on phanerogamous plants. However, we consider that it is correct to refer the fungus to the genus *Phyllachorella* Sydow.

The fungus was found present on two distinct species of *Sargassum*. The stromata of the fungus were usually overgrown with epiphytes. A diagnosis in Latin follows:

Phyllachorella oceanica Ferdinandsen & Winge, sp. nov.

Stromatibus matrici tumefactae insidentibus, strato corticali innatis, nunc unilocularibus, punctiformibus, nunc crustas moriformi-tuberculatas, usque ad 1 cm. latas formantibus, atris. Loculis in tuberculo singulo stromatis pluribus immersis, fere globosis, 500–800 μ diam., supreme strato nigrefacto crasso, quod saepius inter loculos plus minusve prorepit eosque interdum cingit, tectis. Stratis subjacentibus matricis hyphis fungi intertextis. Ascis late ellipsoideis, plerumque 55–77 $\mu \times$ 24–32 μ, sessilibus; paraphysibus nullis. Sporis octonis, distichis, aseptatis, hyalinis, multiguttulatis, plurimis 20–30 $\mu \times$ 10–13 μ, forma (? secundum aetatem) valde varia: saepius ellipsoideis utrinque late rotundatis vel truncatis, rarius fusiformibus, apicula recta subcurvatave predictis.

Species habitatione praedistincta, oceanica, caules nec non vesicas duarum specierum Sargassi, sub nominibus Sarg. II et Sarg. III descriptorum,[2] infestans, Lat. 33° 21′ N. Long., 45° 20′ W. mense Martio, 1914, a cl. C. H. Ostenfeld lecta.—Stromata saepe *Aglaophenia latecarinata* et *Membranipora tuberculata* obsessa.

COPENHAGEN, DENMARK.

[1] F. Theiszen and H. Sydow. Die Dothideales, Berlin, 1915.

[2] In O. Winge: The Sargasso Sea, its boundaries and vegetation. [Report on the "Thor" Expeditions, 1908–10, in the Mediterranean and adjacent seas, 1920.]

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor*]

Readers of MYCOLOGIA are invited to contribute to this department personal news items and notes or brief articles of interest to mycologists in general. Manuscript should be submitted before the middle of the month preceding the month in which this publication is issued.

Dr. W. C. Coker spent the Christmas holidays, December 28 to January 8, at the Garden consulting the library and mycological herbarium. He was checking up a number of fungi from North Carolina, in various groups, for early publication.

Mr. V. C. Dunlap, of Cornell University, spent several days during the Christmas holidays examining specimens of *Pleurotus* in the mycological herbarium. He was a graduate student with Professor Atkinson before he was drafted in 1918. He is now Professor Rowlee's assistant.

Mr. H. S. Bergman, formerly assistant pathologist in fruit disease investigations, Bureau of Plant Industry, has become professor of botany in the College of Hawaii, Honolulu.

The following appointments have been made in Cereal Disease Investigations, Bureau of Plant Industry: Miss Florence M. Smith, from Syracuse University, Miss Jessie I. Wood, from Leland Stanford University, Miss Grace O. Furrow, from the University of Chicago, and Mr. George H. Gillespie, who was engaged during the past summer in the campaign for barberry eradication.

Botrytis cinerea is now held responsible for various kinds of injury to many kinds of plants, and new evidences of its injurious attacks are continually being brought to light. In the *Kew Bulletin* for 1917, an account is given of the killing of a tree, *Aesculus pavia*, by this fungus.

The dreaded walnut blight, caused by *Bacterium juglandis,* which is now widely distributed in America, has been introduced with nursery stock into South Africa. According to Doidge, its development is greatly favored by rain and mist in the early part of the season, when many of the nuts drop from the trees. It is carried over to the next season in leaves and in lesions on the twigs.

Market Pathology and Market Diseases of Vegetables is the title of a very important paper contributed by Link and Gardner to *Phytopathology* for November, 1919. This study grew out of cooperative work during the war to lessen waste in the crop of vegetables after picking. After a general introduction, the various vegetables are taken up in alphabetical order and the principal diseases attacking each one are discussed.

"*Craterellus, Cantharellus,* and Related Genera," by W. C. Coker, with 25 pages and 17 plates, appeared in the *Journal of the Elisha Mitchell Scientific Society* for October, 1919. Seven species of *Craterellus* and twelve of *Cantharellus* are included for North Carolina. The photographs and the drawings of the spores are excellent, as usual. No novelties are described.

The poplar canker, *Dothichiza populea,* was studied by Mr. J. K. Primm in the vicinity of Philadelphia during the summer of 1917 and his results published the following year in the *Journal of Economic Entomology.* The Lombardy poplar suffered most severely, especially where the lower branches were pruned away. The omission of pruning and care regarding drainage are recommended for old poplar trees of all kinds. In the case of young trees, it was discovered that the only nursery which was entirely free from the disease was one that had been sprayed regularly every winter with lime-sulphur mixture.

The mosaic disease of sugar cane, which has been so destructive in Porto Rico, has recently been discovered in Louisiana and other Southern States. A circular distributed by the Porto Rican

Agricultural Station in 1918, prepared by E. D. Colón and F. S. Earle, states that the disease is incurable so far as individual plants are concerned and is probably hereditary. The employment of strictly sound material for propagation, inspection of growing crops at frequent intervals, and eradication of all but unquestionably sound canes are recommended as control measures.

Bulletin 829 of the U. S. Dept. of Agriculture, by E. W. Brandes, contains an up-to-date and full discussion of this disease, with special reference to its occurrence in the United States. Two colored plates accompany the bulletin. Methods of control which originated in Java and Hawaii and have been used with success in Porto Rico are described in detail.

A Revision of the British Clavariae, by A. D. Cotton and E. M. Wakefield, appeared in the *Transactions of the British Mycological Society* for September, 1919. This work of revision was begun in 1905, when it was intended to include all the described species of *Clavaria*, numbering about 400, and to publish a monograph of the entire genus. The confusion regarding European species, however, and the necessity for considerable careful microscopic work, caused the authors to devote their attention at first to the British species, numbering 37 in all, including *C. Broomei* and *C. Invalii,* described as new, and *C. gigaspora, C. Crosslandii, C. straminea,* and *C. persimilis,* recently published elsewhere. *Clavaria fastigiata* is reduced to a variety and 22 names have been excluded from the British list as synonyms or indeterminable. The paper contains excellent descriptions and many interesting notes but no plates, although many references to illustrations are included.

Bulletin 214 of the Connecticut Agricultural Experiment Station comprises the report of the botanist, Dr. G. P. Clinton, for the years 1917 and 1918. Five pages are devoted to the "Inspection of Phaenogamic Herbaria for Rusts on *Ribes* sps.," by Clinton, and 32 pages and 8 plates to "Infection Experiments of *Pinus Strobus* with *Cronartium ribicola,*" by Clinton and Mc-

Cormick. This latter paper is an exceedingly important one, being one of the best contributions published on the biology of this serious disease of the white pine. Other papers in the bulletin deal with spraying and fertilizer experiments.

Professor H. S. Jackson, of Lafayette, Indiana, spent several days at the Garden in February consulting the library and mycological herbarium in connection with monographic work on the rusts for *North American Flora*.

Dr. E. Mead Wilcox, formerly of the Nebraska Agricultural Experiment Station, has been appointed Director of the Santo Domingo Experiment Station, with his headquarters at Santo Domingo. He entered upon the duties of his new position on March 1.

Professor H. C. Beardslee, formerly of Asheville, North Carolina, has definitely retired from school work and will devote himself henceforth to botanical studies in which he is particularly interested. He and Mrs. Beardslee are located for the present at New Smyrna, Florida. Under date of January 25, Professor Beardslee wrote: "I am finding the fungi here very interesting and am getting some good material together."

Dr. Bernard O. Dodge, formerly of Columbia University, is now connected with the Bureau of Plant Industry at Washington, having entered upon his new duties on February 1. On the eve of his departure from Columbia, Professor and Mrs. Harper invited a number of his friends to a farewell dinner at the Faculty Club. Dr. and Mrs. Dodge were extremely active both in general botany and mycology, and they will be sadly missed in New York. It may be, however, that they will find more time for strictly mycological work in Washington.

POLYPORUS EXCURRENS Berk. & Curt.

In preparing a brief article on *Trametes serpens* for the January number of MYCOLOGIA, I stated that Miss Wakefield had

been asked to look up the type specimen of *P. excurrens* at Kew so that it might be compared with specimens called *T. serpens* in America. This she has very kindly done and I have been allowed to get a glimpse of it.

Polyporus excurrens Berk. & Curt. is only a very thin, old, shabby, entirely resupinate form of *Trametes rigida* Berk. & Mont., described in 1849 and later known as *Polystictus extensus* Cooke, *Polystictus rigens* Sacc. & Cub., *Coriolopsis rigida* (Berk. & Mont.) Murrill, and perhaps by other names. This is why I did not find it at Kew, where it is now marked "*Polyporus extensus* B. & C., Cuba, Curtis (*Wright 391*)."

This leaves our American "*Trametes serpens*" without a name. To those who think it sufficiently distinct from *Elmeriana setulosa* (P. Henn.) Bres., of the Philippine Islands, to deserve a separate name, I would suggest **Trametes subserpens.**

W. A. MURRILL.

A CORRECTION

In the article on "Some Described Species of Poria," published in MYCOLOGIA for September, 1919, the attempt to make Saccardo's classification prominent and reference to his work easy led to an error in citation, since many of the species included had already been transferred to the genus *Poria* by Cooke two years previously and Saccardo simply followed his treatment. The correct citations for the first combinations of these species, taken in order, would therefore be as follows:

Poria incrustans (Berk. & Curt.) Cooke, Grevillea 14: 114. 1886.
Poria elachista (Berk.) Cooke, Grevillea 14: 109. 1886.
Poria Salviae (Berk. & Curt.) Cooke, Grevillea 14: 112. 1886.
Poria candidissima (Schw.) Cooke, Grevillea 14: 111. 1886.
Poria calcea (Schw.) Cooke, Grevillea 14: 114. 1886.
Poria interna (Schw.) Cooke, Grevillea 14: 109. 1886.
Poria xantholoma (Schw.) Cooke, Grevillea 14: 113. 1886.
Poria limitata (Berk. & Curt.) Cooke, Grevillea 14: 113. 1886.
Poria tenuis (Schw.) Cooke, Grevillea 14: 114. 1886.
Poria Sassafras (Schw.) Cooke, Grevillea 14: 109. 1886.
Poria Alabamae (Berk. & Cooke) Cooke, Grevillea 14: 113. 1886.
Poria pulchella (Schw.) Cooke, Grevillea 14: 113. 1886.
Poria Caryae (Schw.) Cooke, Grevillea 14: 111. 1886.
Poria dryina (Berk. & Cooke) Cooke, Grevillea 14: 112. 1886.
Poria fatiscens (Berk. & Rav.) Cooke, Grevillea 14: 114. 1886.

Poria decolorans (Schw.) Cooke, Grevillea 14: 113. 1886.
Poria clathrata (Berk. & Curt.) Cooke, Grevillea 14: 112. 1886.
Poria cremor (Berk. & Curt.) Cooke, Grevillea 14: 110. 1886.
Poria rivulosa (Berk. & Curt.) Cooke, Grevillea 14: 109. 1886.
Poria anaectopora (Berk. & Curt.) Cooke, Grevillea 14: 114. 1886.
Poria vesiculosa (Berk. & Curt.) Cooke, Grevillea 14: 114. 1886.
Poria favescens (Schw.) Cooke, Grevillea 14: 113. 1886.
Poria Rhododendri (Schw.) Cooke, Grevillea 14: 113. 1886.
Poria favillacea (Berk. & Curt.) Cooke, Grevillea 14: 111. 1886.
Poria Lindbladii (Berk.) Cooke, Grevillea 14: 111. 1886.

W. A. MURRILL.

A FUND FOR SCIENTIFIC RESEARCH

The Carnegie Corporation of New York has announced its purpose to give $5,000,000 for the use of the National Academy of Sciences and the National Research Council. It is understood that a portion of the money will be used to erect in Washington a home of suitable architectural dignity for the two beneficiary organizations. The remainder will be placed in the hands of the Academy, which enjoys a federal charter, to be used as a permanent endowment for the National Research Council. This impressive gift is a fitting supplement to Mr. Carnegie's great contributions to science and industry.

The Council is a democratic organization based upon some forty of the great scientific and engineering societies of the country, which elect delegates to its constituent divisions. It is not supported or controlled by the government, differing in this respect from other similar organizations established since the beginning of the war in England, Italy, Japan, Canada and Australia. It intends, if possible, to achieve in a democracy and by democratic methods the great scientific results which the Germans achieved by autocratic methods in an autocracy while avoiding the obnoxious features of the autocratic regime.

The Council was organized in 1916 as a measure of national preparedness and its efforts during the war were mostly confined to assisting the government in the solution of pressing war-time problems involving scientific investigation. Reorganized since the war on a peace-time footing, it is now attempting to stimulate and promote scientific research in agriculture, medicine, and in-

dustry, and in every field of pure science. The war afforded a convincing demonstration of the dependence of modern nations upon scientific achievement, and nothing is more certain than that the United States will ultimately fall behind in its competition with the other great peoples of the world unless there be persistent and energetic effort expended to foster scientific discovery.

SECRETARY, NATIONAL RESEARCH COUNCIL.

DAEDALEA EXTENSA REDISCOVERED

This species was described by Peck in his annual report in 1891 as follows:

"Resupinate, thick, coriaceous, often uneven or somewhat nodulose, the margin at first cottony and white, soon changing to brown, the subiculum slightly rufescent; pores large, unequal and labyrinthiform, in vertical places oblique, whitish; spores minute, oblong, .00024 to .0003 in. long, .0001 to .00012 broad.

"Prostrate trunks of deciduous trees. Salamanca. September.

"This forms patches two feet or more in length on the sides and lower surface of the trunk. It follows the inequalities of the surface, and in vertical places it becomes more or less nodulose or develops a thick obtuse margin, which is velvety-tomentose and at length dark-brown in color, but I have seen no reflexed margin. It is suggestive of resupinate forms of *Trametes mollis*, but differs from it in the character of the pores in the thicker subiculum and in the absence of any free margin."

The type collection is gone and there is nothing left but the description; but this, like most of Peck's descriptions, is exceedingly good. I have a specimen collected a few years ago at Bloomington, Indiana, by Van Hook (*2398*) on oak and tulip-tree wood. "This fungus," he says, "grew away from the light, spreading over the surfaces of the two kinds of wood where they lay on each other. It may be a *Poria*, but it looked much like a *Daedalea* when fresh."

This specimen corresponds to Peck's description, except that the hymenium is now avellaneous instead of whitish. I have compared it with a number of resupinate specimens of *Trametes mollis* and find that it differs from them just as Peck said—espe-

cially in the character of the pores, the thicker context, and the absence of any free margin. The young margin is tomentose and whitish, becoming fulvous or brown in dried specimens.

To clear up a doubtful species is much better than to describe a new one; and mycologists are indebted to Professor Van Hook for his timely aid in this addition to our knowledge of a very rare and interesting species, which is now known from two localities instead of one.

W. A. MURRILL.

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THE LIFE HISTORY OF ASCOBOLUS MAGNIFICUS

ORIGIN OF THE ASCOCARP FROM TWO STRAINS

B. O. Dodge

(With Plates 7, 8, and Figures 1–28 in the Text)

During the years since *Ascobolus magnificus* was first described (6), I have been carrying on from time to time culture studies of this fungus with the hope of being able to settle several puzzling questions that have arisen with regard to it. Apparently it has been collected in Porto Riço several times and some of these specimens have been identified by Dr. F. J. Seaver and deposited in the herbarium of the New York Botanical Garden. The identification of the forms from Porto Rico could be checked up by the use of artificial cultures. It is certainly unknown in Europe or otherwise except from my cultures. In this preliminary paper I shall discuss briefly the following topics: (1) The development of the primordia—ascogonia and antheridia. (2) The asexual or *Papulospora* stage. (3) Intrahyphal mycelium. (4) The necessity of two strains in sexual reproduction.

Atkinson (1), in his usual vigorous style, arrayed the evidence against a theory of the origin of the Ascomycetes from the Florideae and endeavored to show how the Oömycetes, through *Dipodascus,* may have been the ancestors of our "higher" Ascomycetes. It was his opinion that the trichogyne could have arisen by the further development of the receptive papilla of the oögonium. He says that no one has ever proved that the multi-

[Mycologia for March (12: 59–114) was issued April 8, 1920]

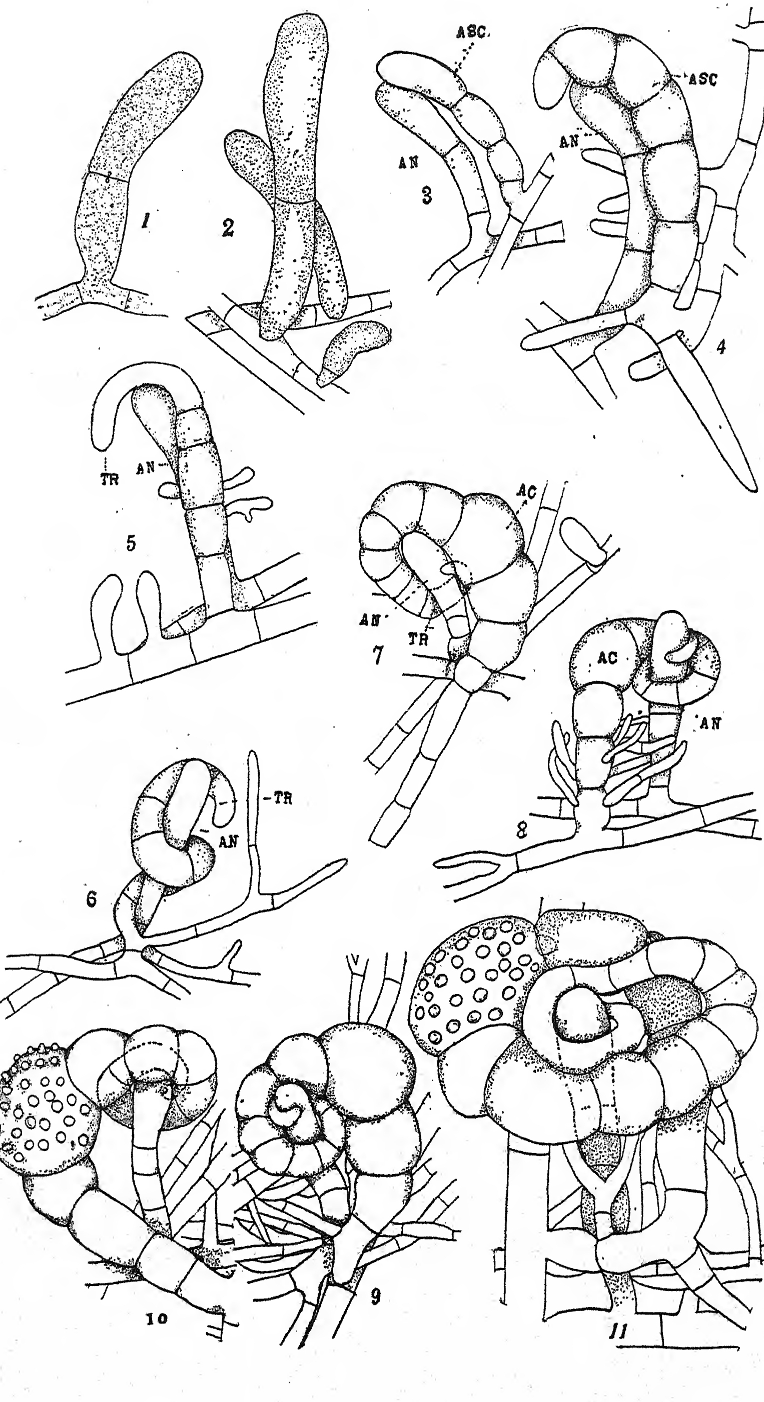
cellular trichogynes of the lichens and other Ascomycetes function in sexual reproduction. These structures have arisen through "progressive sterilization" and are taking on more and more vegetative functions now that sexuality has been lost. About the time Atkinson was formulating this theory, Killian (11) was publishing a preliminary paper on *Venturia* in which he says the nuclei from the antheridium pass into the trichogyne and travel down the long ascogonial coil, the cross walls of which disorganize. The theory of progressive sterilization of the trichogyne is thus overthrown immediately and completely in the event Killian's claim can be confirmed. I have not as yet seen his final paper on the subject (12). In a still later paper on *Cryptomyces* by the same author (13) there are reported other interesting discoveries, all of which, if true, go to show that one should not be too dogmatic in considering a subject such as the sexuality of the Asomycetes about which so little is really known. Little short of a screen demonstration of the passage of the male nuclei from the antheridium into the ascogenous cell will be accepted as final proof that the multiseptate trichogyne functions in sexual reproduction. There are those who deny that in *Pyronema* the simple one-celled trichogyne functions. Brown (2) claims that he studied a strain in which the trichogyne did not fuse with the antheridium at all. Unfortunately he lost this curious strain before his paper appeared in print.

THE ORIGIN OF THE ASCOCARP

In a fertile culture from four to six days old, one can find short one- or two-celled club-shaped branches growing in an erect or oblique position at the surface of the medium. They may be scattered about singly in certain regions (Text fig. 1) or they are more commonly associated in pairs, and sometimes in groups of three or four, all very much alike (Text figs. 2–5). In a very few hours some of the paired branches elongate (Text fig. 4). Both members may be somewhat curved and inclined, one slightly above the other (Text fig. 5). In such case the lower one ceases to elongate and remains a slightly curved two- or three-celled antheridium. Very frequently, however, both structures arise at

a short distance apart; one remains erect, the other elongates rapidly, forming a trichogyne which grows out and circles widely about the antheridium, drawing it up into the coiled portion, the end of which coils tightly about the end cell of the antheridium and fuses with it (Text figs. 8, 10). The habit of growing erect on the surface of the medium is a hindrance to making photographs or camera lucida drawings of the primordia as they develop. The ascogonia are always knocked over on the antheridium and flattened down when a cover glass is used.

It is not at all difficult to prove in every normal case that this club-shaped antheridium is present. By using a high-powered binocular microscope and a pair of the finest dissecting needles, or needles made of glass drawn out, the antheridium can be pulled out of the trichogyne coil provided fusion has not yet taken place. In Pl. 7, figs. 1 and 3, are shown photographs of a pair of young primordia with different magnifications, and figs. 2 and 4 show the same pairs after the antheridium has been pulled out of the encircling trichogyne coil. No fusion has taken place; the antheridium is plump and the contents are granular. An attempt to separate the organs in later stages, that is, after fusion of the cells, always results in a rupture of the trichogyne, sometimes the break occurring adjacent to the ascogenous cell (Pl. 7, fig. 7). In most cases short hyphal branches soon grow out from the stalk of the ascogonium and wrap about the stalk of the antheridium, so that it is impossible to separate the primordia (Pl. 7, figs. 5, 7, 8 and text fig. 8). This evidently is a further provision for maintaining the erect habit. It seems that there are two phases in the life of this species when an abundance of air is necessary, first at spore germination and second at the origin of the ascocarps. Only those ascospores germinate that lie on the surface of the medium and primordia never form beneath the surface of the agar. *A. Winteri* and *A. carbonarius* are indifferent to the amount of air at both of these periods. The ascogenous cell, which can soon be recognized, begins to enlarge rapidly (Text figs. 7, 8, 9, and Pl. 7, fig. 9) and ascogenous hyphae grow out in considerable numbers sometimes before sterile hyphae have begun to bud out to form the fruit body. (Text figs. 10, 13, 14, 15.)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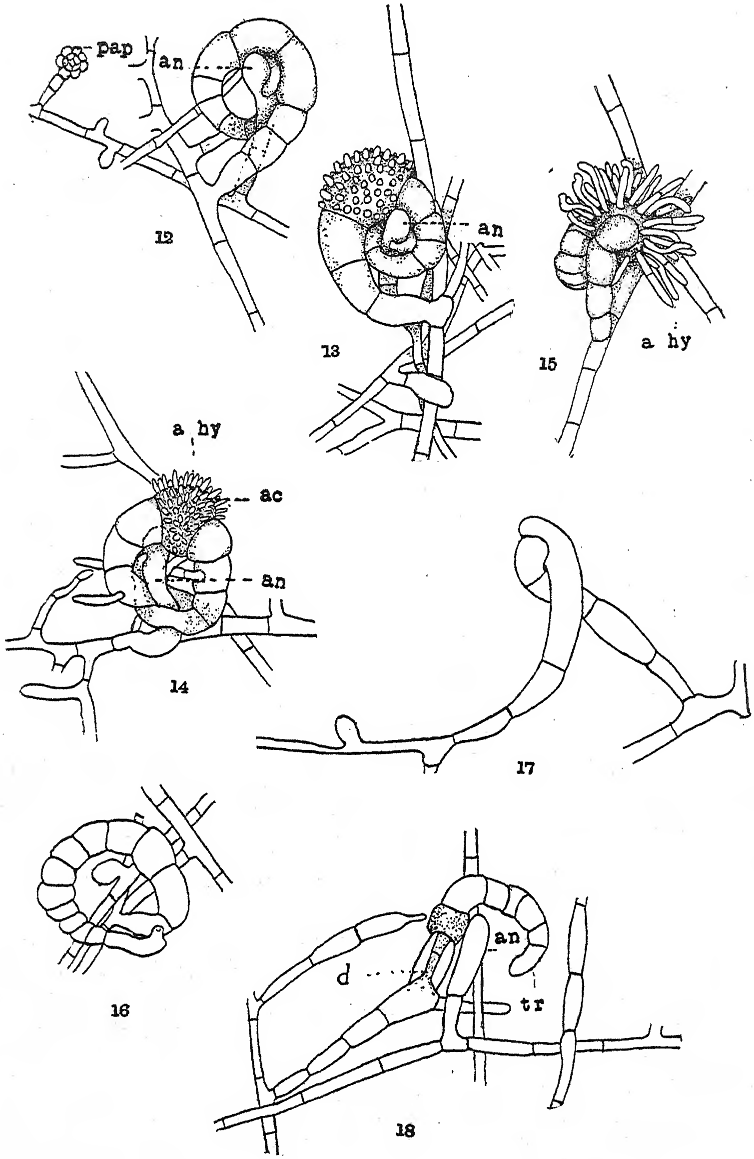
The form which the ascogonium takes as it develops depends greatly upon the position of the antheridium. Cases are illustrated in Text fig. 6 and in Pl. 7, fig. 6, in which the ascogonium becomes spirally coiled about the antheridium. In the latter figure the end of the trichogyne is plainly visible as it coils about the end of the antheridium. The type shown in Pl. 7, figs. 5, 8, is very common and fig. 10 shows another fairly common type in which the trichogyne makes a wide sweeping coil and the end runs upward along the antheridium (Text figs. 12, 14). Text fig. 15 shows a form in which the ascogenous hyphae have grown out to a considerable length before a single sterile hypha has appeared from the stalk of the ascogonium. The antheridium arises from the hypha crossing beneath from an oblique angle so that it is not shown in the figure. A rather complicated system is shown in Text fig. 11, in which it is difficult to determine the origin of the antheridium, and the trichogyne seems to be unnecessarily long. The antheridium is frequently quite a distance away and it may be that there is an inherent tendency to develop a long trichogyne even in cases where the antheridium grows nearby. In the specimens illustrated in Text fig. 10 the antheridium is really at some distance from the ascogonium, but the preparation was crushed down with a cover glass so that the ascogonium fell over on the antheridium as it always does in mounting the primordia. The camera lucida drawings reproduced in the text were made eight years ago from material preserved for a time in glycerine and then mounted in glycerine jelly. These preparations are very transparent, flattened out and distorted, still the essential features can be made out. Better preparations were made this

TEXT FIGS. 1–11. 1. A single two-celled primordium. 2. A group of three structures, two of which may pair up. 3. A typical pair of primordia, both curved, one lying slightly above the other. 4. The ascogonium arises from the end cell of a hypha and curves over the antheridium. 5. Trichogyne beginning to coil about the antheridium, the ascogenous cell not yet differentiated; sterile hyphae are growing out of the stalks of the primordia. 6. Spiral archicarp. Compare with fig. 6 in Plate 7. 7. Fertilization has taken place; the ascogenous cell is differentiated. 8. Outgrowth of sterile hyphae from the base of the archicarp. 9. The most common type of primordia. 10. Ascogenous hyphae beginning to grow out. These primordia are exceptionally long-stalked. 11. Complicated coil with a long trichogyne.



TEXT FIGS. 12–18. 12. *Papulospora* on the same hyphae with the antheridium. 13. Club-shaped aborted structure near functional primordia. 14. Shows a trichogyne somewhat entangled coiling about the antheridium and the stalk of the ascogonium; ascogenous hyphae well advanced. 15. Long ascogenous hyphae have grown out before the sterile hyphae from the stalk of the

year by mounting primordia directly from Flemming's weak fixative (after washing) into glycerine jelly. The darkening effect of the fixative is an aid in photographing the primordia.

I have previously described the young apothecium (8), pointing out that the hymenium is never covered by a pseudoperidium of sterile cells, such as we find in *A. furfuraceus*. *A. magnificus* is exactly like *Pyronema* in this respect. That an apothecium is "at first closed, then opens," in various ways or that the "hymenium is exposed from the first," these are specific but not necessarily generic or family characters in the Discomycetes.

In any fertile culture there can be found a great number of aborted ascogonia. The trichogyne may sometimes be unable to connect with the antheridium (Text fig. 16), or this structure may not mature sufficiently. In Text fig. 18 a good antheridium is shown to have developed but something evidently prevented fertilization. The paired structures shown in Text fig. 17 did not develop completely. Owing to the large size of apothecia of this species only a relatively small number reach maturity in any one culture, but hundreds of primordia are developed in dung cultures and large numbers of apothecia begin growth without maturing unless the older apothecia are removed or die out. Occasionally I have found that the ascogonium affects a weak union with a club-shaped structure developing on the same hypha, suggesting that rarely both sex organs may arise from the same hypha, and other cases where the trichogyne becomes attached to the stalk cell of the ascogonium (Text fig. 16). All such irregularities or abnormalities appear to come to nothing. In most of my text figures the hypha bearing the antheridium appears to lie below that from which the ascogonium arises. This is not necessarily true for every case, as the fertile hyphae may run parallel to each other or the branch bearing the antheridium may lie uppermost and run at any angle to the other.

ascogonium have made their appearance. The antheridium arises from the hypha crossing at an angle. 16. An aborted archicarp, the trichogyne appears to have become slightly attached to the basal cell of the archicarp. 17. A pair of aborted structures such as are frequently found in cultures. 18. "Durchwachsung," the stalk of the archicarp. A well-developed antheridium is present but the trichogyne did not function for some reason.

In such forms as *A. Winteri* and *A. furfuraceus* fully developed normal ascogonia can be found on hyphae where there is no indication whatever of a structure which in any way resembles an antheridium. I am convinced that these species do not possess morphological antheridia, although fertilization may take place in some other fashion. There can be no question, however, of the necessity for both kinds of sex organs in *A. magnificus*. This cannot be over-emphasized, since many students of the Ascomycetes are inclined to accept the view that sexuality exists in only a few forms like *Pyronema* and the powdery mildews.

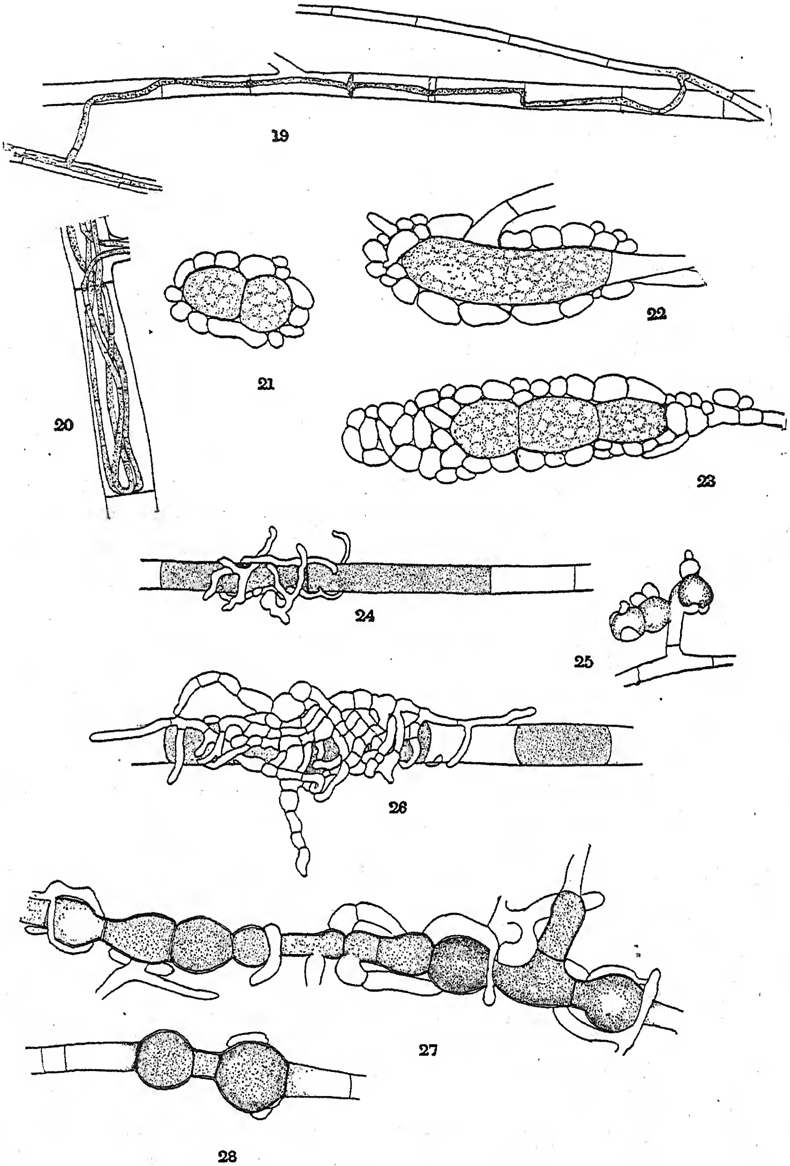
The primordia are visible even without a hand-lens and it is possible to determine within a few hours just when they will first make their appearance in the Petri dish culture. Flemming's weaker fluid is then poured into the dish which can be set aside for examination at leisure. The circle of agar can be floated out into a large battery jar, where it can be washed to remove the fixative previous to mounting the primordia in glycerine jelly. It is much better to study them while they are covered with Flemming's if one is interested in tracing the hyphal connections with them. An oatmeal agar or a potato agar is favorable for the production of large numbers of papulospores or large amounts of mycelium, but the starchy media should not be used if ascocarps are desired. I have dissected a very large number of primordia and have not found a single case where a normal, vigorously growing ascogonium was not accompanied by an antheridium and this is a pretty good indication that there is one species of *Ascobolus* at least in which the sexuality has not been lost or reduced.

We may now turn to the asexual method of reproduction of this species. Many common species of *Ascobolus* in Europe and America are, so far as reported, devoid of asexual spores. *A. parasitica,* described by Van der Wolk (14), is said, on little evidence, to possess a Sclerotium stage as well as a *Rhizostilbella* stage. I have described the curious spore-like bodies that grow in pure cultures of *A. carbonarius* (5). The ascogonia arise directly from certain of these "spores," but further study will be necessary to settle the question as to the exact nature of the others.

PAPULOSPORA MAGNIFICA

A very good illustration of the inadequacy of a classification of fungi based on asexual stages is the genus *Papulospora* as understood by Hotson (3). A true papulospore might be defined as one in which one or two large central storage cells are surrounded by a covering of hyphae which develop from blister-like outgrowths of the storage cell. Hotson has described a number of species and points out that these forms may belong to perfect stages of species in various groups of fungi, that is, *Papulospora* is the bulbil asexual stage liable to be found anywhere among the Ascomycetes.

Papulospores of the type shown in Plate 8, figs. 5, 6, 7, and Text figs. 21, 25, appear in about ten days in all cultures of *A. magnificus* which I have obtained by germinating ascospores. The spores are very hard to germinate, but I have been able to make hundreds of "pure" cultures, many of them one-spore cultures. The papulospores do not germinate readily, either, so that I have made only a few cultures by growing them. I have transferred the mycelium of these one-papulospore strains to several kinds of media without being able to obtain the ascocarps of the *Ascobolus*. At my request Professor J. W. Hoston made an extensive study of the *Papulospora* and published his results describing the species as *P. magnifica* (4). He was unable to obtain ascocarps from the culture which I sent him, and therefore concluded that there was not sufficient evidence to warrant assuming without further proof that it might be an asexual stage of *A. magnificus*. He thought it might occasionally be an intrahyphal parasite as I had once imagined (7). Mr. E. S. Schultz also made a pure one-spore culture of this *Papulospora* for me. I was unable to obtain ascocarps by growing this strain in various media. *Papulospora* stages have been connected with the Melanosporas and there is a very close resemblance between the bulbils of *P. magnifica, P. candida, P. parasitica, P. coprophila* and those of the Melanosporas studied by various investigators.



TEXT FIGS. 19–28. 19. Intrahyphal mycelium in an old culture of *Ascobolus carbonarius*. 20. Intrahyphal mycelium of *A. magnificus*. 21. A papulospore of *A. magnificus* with 2 central cells. 22, 23. Chains of storage cells (papulospores?) surrounded by small hyphae. Such bodies are of frequent occurrence

INTRAHYPHAL MYCELIUM

In old plate cultures it is not difficult to find internal hyphae running back and forth, in and out of the larger hyphae (Pl. 8, fig. 2 and Text fig. 20). Papulospores sometimes arise directly from branches growing out of these internal hyphae. It is only recently that I have been able to prove positively that this is not a case of parasitism of *Papulospora* on *Ascobolus*. On the contrary, it is simply a good example of what has been described under various names, such as Durchwachsungen, cordon interne, accroissement perforant, etc. In old cultures of certain fungi, one can find where bridging hyphae grow out from living cells through dead ones (Pl. 8, figs. 1, 3, 4), and connect up with the next living cells. It is said that a new wall may be formed about the reduced cytoplasm of an old cell, thereby constructing a new hypha of a shorter diameter which occupies only a small portion of the old cell cavity (31). It may happen that for long distances the cells of the hyphae degenerate so that the bud that grows out to bridge the gap must pierce many cross walls (Pl. 8, fig. 2 and Text fig. 19). We thus have what looks like the intrahyphal mycelium of a fungus parasite or a case where a fungus is parasitic on itself. The cross walls of the internal hyphae do not in any way correspond to those of the outer hypha whose septa not infrequently become almost invisible. Sometimes the internal hypha, unable to penetrate the cross wall at the first point of contact, runs along the wall to the other side where it may be able to push through, if not it returns through the same old cell and winds about several times before growing out into the medium. There is usually a swelling on the internal hypha where it passes through a septum of the big cell. De Bary describes *Cicinnobolus* as an intrahyphal parasite of the powdery mildews. Many persons who have investigated the subject of Durchwachsungen have remarked on the close re-

in old cultures on a dung decoction agar. 24, 26. Surface views of heavy-walled brownish cells surrounded by entangling hyphae. 25. Young papulospore that will eventually possess three central storage cells. 27, 28. Chlamydospore-like storage cells, papulospores?.

semblance to parasitism. As Zopf (20) says, "Oft sind entleerte Fäden auf weite Strecken hin von vielfach hin und her gebogenen Keimschläuchen ganz ausgefüllt. Fast möchte man angesichts solcher Bilder glauben, man habe einen fremden Organismus vor sich der als Parasit in den Chaetomienhyphen hause." Text fig. 19 is from an old culture of *A. carbonarius* where there can be no question as to the nature of this internal hypha. Various examples of this phenomenon are reported in the literature and I have arranged a number of the references in the following table:

TABLE I

REFERENCES TO SELF-PENETRATION, DURCHWACHSUNGEN, ETC.

Author	Date	Species
Gasparrini	1856	*Lemna minor*
Schleiden	1872	Saprolegniaceae
Kny & Magnus	1879	Marchantiaceae
Pringsheim	1873	*Saprolegnia*
Kny	1873	*Dasya*, *Hypnea*
Zopf	1881	*Chaetomium*
Brefeld	1881	*Ascoidea*
Borzi	1885	*Inzengeae*
Holterman	1885	*Ascoidea*
Lindner	1887	*Epicoccum, Alternaria, Botrytis*
Rothert	1892	*Sclerotium hydrophilum*
Klöcker & Schönning	1895–98	*Dematium pullulans*
Ternitz	1900	*Ascophanus carneus*
Duggar & Stewart	1901	*Rhizoctonia*
Beauverie & Guilliermond	1904	*Botrytis cinerea*
Molliard	1904	*Morchella esculenta*
Appel & Bruck	1906	*Sclerotinia libertiana, Botrytis*
Guilliermond	1908	*Gloeosporium nervisequum*
Lewis	1909	*Griffithsia*
Dodge	1912, 1915	*Ascobolus magnificus*
Dodge	1918	*Gymnosporangium*

When the teleutospores of species of *Gymnosporangium* are formed the young spore buds often grow into and through the old buffer cells above (36). If the intrahyphal mycelium found in the powdery mildews is that of a fungus parasitic on another fungus, then it is the only case of the kind known. All of the other examples of this phenomenon have been proved on further investigation to be due to self-penetration, "Durchwachsungen," "d'accroissement perforant," or self-parasitism, so to speak.

Compare Neger's figures of *Melanospora marchica, Papulospora* stage (15) with my figures, Pl. 8, also compare the "groups of chlamydospore-like structures" of *M. papillata* (Hotson, Pl. 2, fig. 7) with my text figures 22 and 23; and further, the "*Acremoniella* type" of spore of *M. cervicula* (Hotson, Pl. 3, fig. 17) with those shown in text figs. 27, 28, and one is struck with the close parallelism between the asexual reproductive bodies of *Melanospora* and those of *Ascobolus magnificus* and the spore balls of *Urocystis* type. As noted we have been unable to obtain ascocarps from one-spore cultures of *P. magnifica*. Furthermore, I have no record of obtaining ascocarps from a one-ascospore culture of *A. magnificus*.

Two Strains Necessary for Sexual Reproduction

I have stated in connection with the description of the primordia that the ascogonia and antheridia ordinarily (or perhaps always) arise from different hyphae. This fact early suggested the reason for the sterility of one-spore cultures. If one sows ascospores in a dung culture he may obtain ascocarps. If they are sowed in an agar medium under proper conditions germination may take place rarely, and I have frequently obtained ascocarps from such cultures, but I have noticed that when one or two transfers of mycelium are made from these fertile cultures the subcultures are apt to be sterile. This is especially true where the ends of the hyphae are cut off and transferred from young cultures. I have planted a single spore on agar in petri dishes and on sterile dung in jelly glasses in several hundred cases without obtaining a single germination, so rarely do the ascospores germinate. On August 16, 1919, I planted ascospores on agar in each of ten petri dishes, heating the cultures at 60° C. for twenty minutes. After twenty-four hours no germination had taken place. On September 2, mycelium was found in seven of the dishes and papulospores were present in each case, but there were no primordia or ascocarps. Transfers of mycelium were made to tube and plate cultures and on September 4 sterilized horse manure in jelly glasses was inoculated with the strains numbered 1, 2, 3, 4 and 5. Strain 6 was lost and strain 7 was

not used. Strain 2 was planted alone and in combination with strains 1, 3, 4 and 5, with the result that in ten days numerous ascocarps appeared on the cultures containing strains 2 + 1 and 2 + 4, while in the cultures containing strains 2, 2 + 3 and 2 + 5,

TABLE II

SUMMARY OF CULTURES OF *Ascobolus magnificus* FROM VARIOUS COMBINATIONS OF STRAINS—1, 2, 3, 4, 5, AND 7

Medium	No. of Cultures	Strains Used	Results	
			Positive	Negative
Sterilized fresh horse manure in jelly glasses and milk bottles	26	2	0	26
	7	1	0	7
	3	3	0	3
	21	4	0	21
	3	5	0	3
	5	7	0	5
	7	2+1	6	1
	2	4+1	0	2
	3	2+2	0	3
	2	2+3	0	2
	22	2+4	21	1
	2	2+5	0	2
	3	2+7	2	1
	3	3+4	3	0
	2	4+4	0	2
	3	5+7	3	0
Horse dung decoction agar in Petri dishes	3	1+1	0	3
	3	1+2	3	0
	1	1+4	0	1
	1	1+5	1	0
	1	1+7	0	1
	36	2+2	0	36
	1	2+3	0	1
	52	2+4	52	0
	5	2+7	5	0
	1	3+3	0	1
	2	3+4	2	0
	40	4+4	0	40
	3	4+7	0	3
	5	5+4	5	9
Horse dung decoction agar in 12-in. test tubes	28	2	0	28
	5	2+2	0	5
	26	4	0	26
	3	4+4	0	3
	20	2+4	19	1
	5	1	0	5
	3	3	0	3
	6	5	0	6
	5	7	0	5

1 Results are positive when ascocarps appear in cultures, and negative when no ascocarps appear within a month.

there were no fruit bodies although papulospores could be found in all of the cultures. The last three cultures have not produced ascocarps. The following table shows cultures of which a record was kept in testing out the strains. Many others were made simply to obtain primordia for purposes of study.

It is clear that at least for these strains each is sterile by itself or strains 2, 3 and 5 are sterile (in the combinations tested) when placed together, as are strains 1, 4 and 7, but a combination of any one of either group with any one of the other group produces a fertile culture. I have since obtained ten new strains from germinated ascospores. These strains fall into two groups, two of which are like the original No. 2 and eight are like No. 4.

The use of sterilized fresh horse manure in jelly glasses or in milk bottles is preferable when it is simply desired to ascertain whether single strains ever become fertile because this is the natural substratum and the ascocarps reach a large size whenever the culture is fertile. On the other hand, when the fertility of two strains in combination is to be tested one of the transfers may not grow and it is then impossible to draw any conclusions whatever from negative results. Whenever papulospores are found it is certain that one strain has developed a mycelium, while the other may not have grown at all. On the other hand, plate cultures obviate this difficulty since it can be seen (within 24 hours) whether either strain has begun to grow, and if one has not a reinoculation can be made. No single strain culture on dung is reported sterile in the above table where an examination was not made to find papulospores, thus proving that the inoculation was successful. Twelve-inch test tubes containing the dung decoction agar are most satisfactory for keeping pure cultures for a long time. Ascocarps up to a centimeter in diameter have been grown in these large tubes, while I have not been very successful in growing ascocarps in small test tubes.

Not all of the possible combinations of strains 1, 2, 3, 4, 5 and 7 have been tried in these different ways, because the first thing desired was a combination that was sure to produce primordia for purposes of study. Strains 2 and 4 were chosen for the most extensive tests, and it can be said that each is sterile by itself and

fertile in combination with the other after many transfers. The first sub-cultures of strains 2 and 1 on dung in jelly glasses remained sterile from October 10 to January 6, but produced ascocarps within five days when both strains were grown together on dung in a milk bottle.

BEHAVIOR OF MYCELIA IN CULTURE

If a petri dish culture is inoculated on opposite sides with the same strain (4 + 4), the mycelia grow out at the same rate from both sides until they meet along a straight line through the center. There is a narrow region between the two mycelia which remains comparatively free from hyphae as though there was an antagonism or repulsion between the two. Now, if opposite strains such as 2 and 4 are planted in the same culture, the mycelia grow out at about the same rate, meeting near the center of the culture where there appears to be, for a brief period a slight antagonism, at least the rate of growth is much reduced, then the hyphae from either side can be found growing freely across the line of meeting, making a zone plainly visible across the center composed of hyphae from both strains. Numbers of ascogonia and antheridia soon make their appearance, not necessarily at all in a line across the center, such as one finds in the cultures of *Rhizopus*. The hyphae grow so rapidly that both strains are soon found throughout the culture and ascocarps appear in any region whatever. The largest numbers of sex organs, however, generally appear first near the line of meeting of the mycelia and one or two cm. from the periphery.

In view of Blakeslee's discoveries of plus and minus strains in the Zygomycetes and his theories regarding their sexuality, and Burger's recent report on the "pseudo-heterothallic" condition in *Cunninghamella* (15a), it is of importance to determine the question of the sexuality of the strains in this *Ascobolus*. Each of the strains so far isolated is self-sterile, and no sex organs are produced in a one-strain culture. Ascogonia and antheridia ordinarily arise from different hyphal branches. How universal this rule is, I am not prepared to say. I have not seen any good evidence of fertilization between structures arising

side by side on the same hyphal branch. The hyphae of this species are large and they can be traced for long distances in a transparent dung-decoction agar. Anastomoses occur frequently in fertile cultures near primordia, but the question of the sexuality of the strains will not be a difficult one to determine.

Shear (9) has studied species of the genus *Glomerella* and made large numbers of one-spore cultures from ascospores and conidia. He finds that many such strains are fertile in themselves, while others are sterile. He has grown various strains and cultures together without obtaining evidence of what might be called plus and minus strains. Edgerton (10), however, states that he has repeatedly isolated plus and minus strains of *Glomerella* from one-spore cultures. One strain when planted alone produces some perithecia as will the other when it is grown by itself, but when both plus and minus strains are grown together there is a dense black line of perithecia formed where the strains meet. There are, however, perithecia scattered about elsewhere in the culture. Edgerton was unable to find structures corresponding to oögonia and antheridia; however, he offers a theory to account for the behavior of his strains.

No sex organs are developed in the strains of *Ascobolus magnificus* mentioned above except under the contact or chemical stimuli of two strains in the same culture. Are archicarps formed on one strain and antheridia on another? Will each strain remain self sterile indefinitely? Are strains segregated at the time of ascospore formation? Are there neutral strains or pseudo-heterothallic strains? All of these questions remain interesting subjects for further investigation.

SUMMARY

1. The ascocarp of *Ascobolus magnificus* originates from a pair of morphologically distinct primordia—a large ascogonium the end of which functions as a trichogyne, and a club-shaped antheridium.

2. *Papulospora magnifica* Hotson is an asexual stage of *Ascobolus magnificus* Dodge.

3. The intrahyphal mycelium found in old cultures is simply a case of "Durchwachsungen," or "cordon interne."

4. The strains here reported, which were obtained from germinated papulospores or ascospores, were self-sterile in the experiments conducted, but always produced papulospores.

5. Sexual reproduction occurs in cultures containing two strains properly chosen.

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EXPLANATION OF PLATES

PLATE 7

Fig. 1. Primordia before fertilization, trichogyne not fully developed.

Fig. 2. The same pair of primordia after the antheridium had been pulled out of the trichogyne coil.

Figs. 3 and 4. Same as Figs. 1 and 2 except less highly magnified. The coiled portion of the ascogonium (trichogyne?) shows more distinctly in this position than in Fig. 2.

Figs. 5 and 8. Common types of primordia in which the antheridium is circled by sterile hyphae from the stalk of the ascogonium.

Fig. 6. Spiral type in which the trichogyne is plainly visible coiling about the end of the antheridium.

Fig. 7. Archicarp broken in two in an attempt to pull the antheridium away from the trichogyne after fusion had taken place.

Fig. 9. Short-stalked archicarp, the antheridium not visible.

Fig. 10. Same type as shown in Fig. 9 except that the antheridium is plainly visible.

PLATE 8

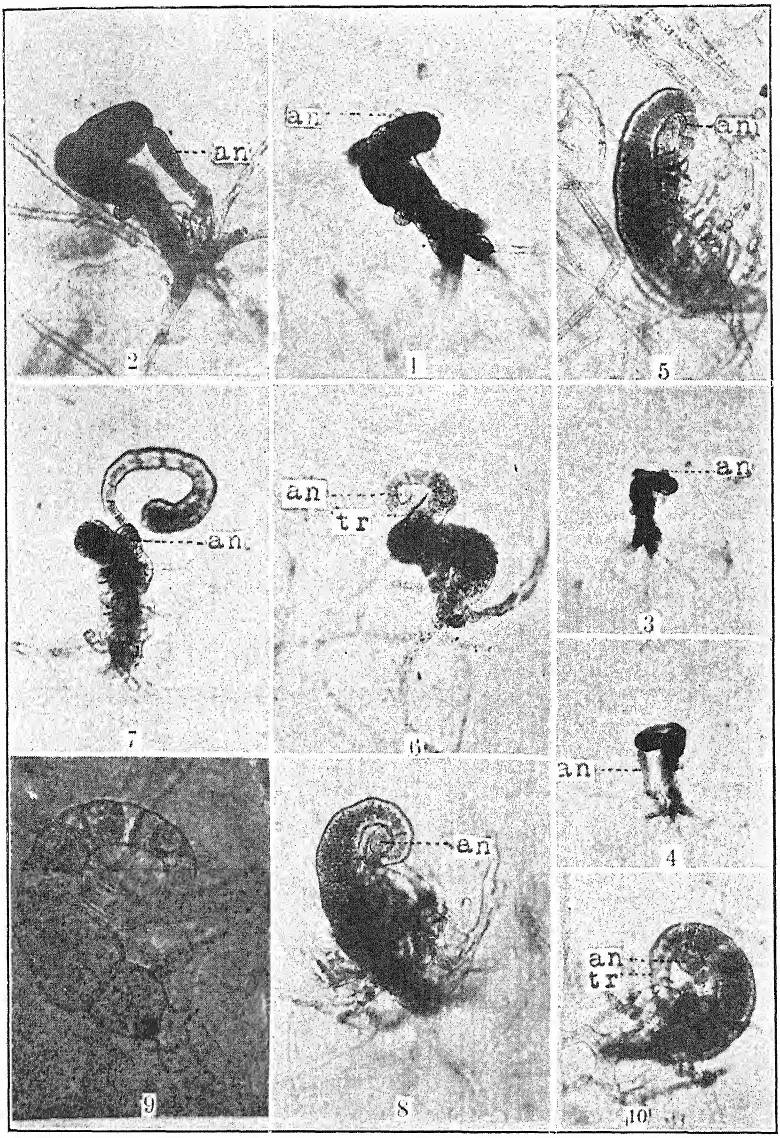
Fig. 1. Hyphae bridging a dead cell and connecting two living cells.

Fig. 2. Intrahyphal mycelium resembling the mycelium of a fungus parasite.

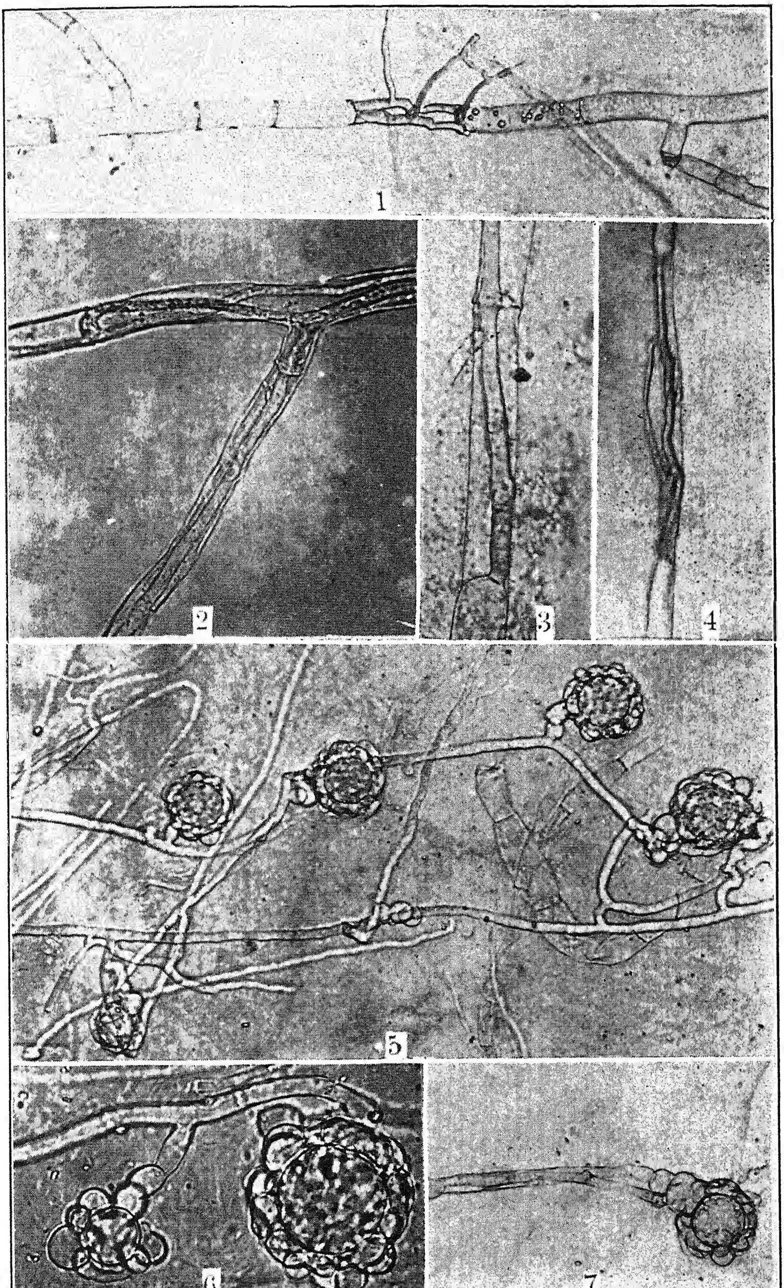
Figs. 3 and 4. Clearly the "Durchwachsung" type of bridging hyphae.

Figs. 5 and 6. Papulospores of *Ascobolus magnificus*. At the right in Fig. 5 can be seen a few cells of a hypha of large diameter. Note the small hyphae from which the papulospores arise. This is not always the case as these spores frequently arise from hyphae of large diameter.

Fig. 7. Papulospore arising from an "internal hypha."



Ascobolus magnificus Dodge



ASCOBOLUS MAGNIFICUS DODGE

SOME MYCOLOGICAL NOTES FOR 1919*

L. O. Overholts

(With Plates 9 and 10)

The fungous flora of the mountains of central Pennsylvania is perhaps as rich and as varied as in any other region of the United States. The summer of 1919 was marked by an unusual abundance of rainfall that brought forth such a crop of fungi as had not been produced since 1915. Intensive and extensive collecting over several years has added scores of hitherto unreported species to the fungous flora of the state. A considerable number of these are of rare occurrence or for other reasons are only imperfectly known. It is hoped that the present paper with the accompanying photographs will help to give these few species a more prominent place in the mycological literature of the country.

1. Clavaria ornatipes Peck

The writer has collected Clavarias in considerable abundance for several seasons past, but this is the first collection of this interesting species. The name of Peck's species *C. bicolor* (later changed to *C. vestitipes*) for a different plant, would fit this plant nicely, for the color contrast between the drab-gray branches and the wood-brown (Ridgway's colors) stem is quite marked. Persoon's name, *C. trichopus,* for a similar if not identical plant, refers to the abundant ascending gray-brown stiff hairs that clothe the stem. *C. vestitipes* Peck is a much smaller plant. *C. krombholzii* Fr. (ex Lloyd) is similar in stature and branching but uniformly white in color. The spores of my specimens are globose, smooth, hyaline under the microscope, and measure 8–10 μ in diameter. The content is quite granular.

* Contribution from the Department of Botany, The Pennsylvania State College, No. 22.

2. CRATERELLUS PISTILLARIS Fr.

This interesting species was collected in abundance in the Seven Mountains of Center County, on August 24. About 25 specimens were found along an old forest trail in the vicinity of Bear Meadows. Dr. Burt reports[1] but three localities in this country, viz., New Hampshire, Vermont, and Michigan for the species. Professor E. T. Harper has published[2] some excellent illustrations and given some critical notes on the species.

My plants were somewhat larger than the measurements recorded by Dr. Burt, the largest specimens being 16 cm. tall and 7 cm. thick at the apex. A few specimens were somewhat compressed and flabelliform in shape and one specimen was strongly 2-lobed at the apex. The color of the nearly smooth hymenium varied from light pinkish cinnamon to vinaceous cinnamon of Ridgway. The specimens grew in a mixed hard-wood forest, chestnut and oak predominating.

3. FOMES BAKERI (Murrill) Sacc.

Plate 9, figs. 1, 2

On species of birch in the middle-western United States there has been known for some time a *Fomes* that by most collectors was referred to *F. igniarius* Fr. In 1908, Murrill[3] described this as a new species under the above name and later reported[4] its range as "Wisconsin, Missouri, and westward." In 1915, Lloyd referred[5] this plant as a variety of *F. robustus* Karst., known in this country only from California. The writer added[6] an Ohio locality in 1915 and pointed out that while the type collection was made by C. F. Baker, yet the plant distributed under that name by him in Plants of Southern California, 5188, was a different species, probably *Polyporus gilvus.*

On the basis of these references the species was not believed to occur east of the Appalachian Mountains, and it was with con-

[1] Ann. Mo. Bot. Gard. 1: 342. 1914.

[2] Mycologia 5: 263. 1913.

[3] N. Am. Flora 9: 104. 1908.

[4] Northern Polypores, p. 48. 1914.

[5] Synopsis of the genus Fomes, p. 243. 1915.

[6] Polyporaceae of the Middle-Western United States, p. 61. 1915.

siderable surprise that on November 22, 1919, a dead standing sweet birch (*Betula lenta*) was observed bearing a number of excellent sporophores of what proved to be this species. These are the largest sporophores yet seen, and some of them are more applanate than is usually the case. The largest specimen measures 13 × 20 × 5 cm. The tree that bore these sporophores was about two feet in diameter and was later felled for observations as to the characteristics of the decay produced. It was found that the fungus is a sap-wood destroying organism, although perhaps encroaching to some extent on the heart wood. But in the center of the tree there was a cylinder of the dark red, sound heartwood characteristic of this species of tree. Pieces of the log containing both sapwood and heartwood were brought into the laboratory and at the present writing the fungous mycelium has grown out over the surface of the sapwood in a brownish-olive mat, but has not appeared on the adjacent heartwood. The decayed wood has no striking characteristics but the decay appears to be of the general delignifying type, whitening the wood and rendering it brittle but not friable. This habit of being largely confined to the sapwood serves to emphasize the distinction between this species and *F. igniarius* — a heart-rotting organism.

A search was then made in the herbarium material representing allied species of this fungus with the result that two additional collections were discovered, both from Pennsylvania. One was taken by Dr. A. S. Rhoads, on *Betula lutea* in Philadelphia, Pa., December 27, 1915, the other by the writer, on *Betula lenta*, February 24, 1918, in the mountains near State College. It is a curious fact that of the three Pennsylvania collections two were from trees growing on the exposed summits of mountain ridges, while in the state of Missouri the writer knew it as frequenting the birches in the lowlands along streams.

Plants of this species are not as firm and hard as is *F. igniarius*, and they lack the white incrustation found in the older layers of tubes of that species. In addition the tubes are distinctly stratified (see fig. 2) and the context has a decidedly silky luster similar to that in *Fomes everhartii*. These points serve to distinguish the species from its allies.

4. Merulius aureus Fr.

Plate 10, fig. 4

This is one of the more uncommon species of *Merulius*. An excellent collection was made October 5 on the decorticated trunk of a pitch pine (*Pinus rigida*) near State College. In these specimens the plant is largely resupinate but with a definite reflexed border in many cases. The largest specimen had a spread of 15 cm. in length and about 5 cm. in width. The color of the young plant, or the growing margins of older resupinate specimens is buff yellow or light orange yellow. The color of the reflexed pileus is close to yellow ochre and varies from finely pubescent to glabrous. The color of the hymenium is not closely matched in Ridgway's Manual, being darker than zinc orange and too bright for cinnamon rufous. Xanthine orange is probably closer. The color is quite similar to that of *Paxillus corrugatus* and the configuration of the hymenium suggests a relationship with that plant. The absence of any odor, however, immediately corrects any impression that it might be that species. This collection shows quite well that when first formed the fruiting bodies are nearly orbicular and 0.5–1.5 cm. broad. They soon become laterally confluent to the measurements given above, but even in such specimens it is often possible to trace the limits of the original sporophores, as the folds are often sub-lamellate and radially arranged from the center. The spores are oblong or short-cylindric and sometimes pointed at one end, smooth, hyaline under the microscope, and measure $3–4 \times 1.5–2\,\mu$; cystidia none. Dr. Burt states that in mass the spores of the species are somewhat yellowish, but light spore falls obtained from these specimens are colorless.

5. Mucronella ulmi Peck

Plate 10, fig. 5

This peculiar plant has been found in considerable abundance for the first time since its appearance here in 1915. Its small size makes it very inconspicuous and easily overlooked. It grows on the bark on the north side of a living *Ulmus americana*

tree on the campus of the Pennsylvania State College. A lavender or purplish tint has been noted on the teeth this season.

The genus *Mucronella* is characterized by short awl-shaped teeth that arise directly from the substratum without the intervention of a subiculum. It thus approaches some of the small Clavarias in habit, and some would include the genus in the *Clavariaceae*. In some species, as the present one, the teeth are not separate but are united several in a fascicle, approaching the form of a diminutive *Hydnum erinaceum* or related species.

Mr. Lloyd has recently summarized[7] our knowledge of the taxonomy of the genus. He lists five species, four of which have been reported from the United States. Two of these are now known to occur in Pennsylvania. The plants are extremely rare, however, and no other account of the species of the United States has been published. I take this opportunity, therefore, to present a photograph and a few remarks concerning the species.

The genus as originally founded was said to have one-spored basidia. I have examined my material carefully but no spores or sterigmata were seen, though young basidia were abundant. The following descriptive notes are appended:

Plants white, drying gray, composed of few or several awl-like teeth, 2–4 mm. long, united by their bases into small clusters 2–4 mm. broad and 2–5 mm. long; spores not obtained; cystidia none.

On bark of living elm trees. October.

6. PAXILLUS CORRUGATUS Atk.

A collection of this rare plant was made at Shingletown Gap, Center County, Pa., August 16, 1919, on the bark and wood of a fallen *Pinus rigida*. The species is easily recognized by the very strong odor and the corrugated gills that are near ochraceous buff (Ridgway) in color. The odor is very characteristic and unlike that of any other fungus. It has persisted until the present time in a Kentucky collection preserved in the writer's herbarium since 1909, when it was collected by Dr. Bruce Fink. Parts of the present collection were very largely resupinate.

[7] Mycological Notes No. 39, pp. 531–533. 1915.

The species was originally described from New York by Professor Atkinson. Kauffman also reports a station for it in Michigan.

7. POLYPORUS SCHWEINITZII Fr.

This polypore, rather common in Pennsylvania on conifers, especially species of pine, was collected near Boalsburg, Pa., on the roots of a living tree of *Quercus alba*. This is probably an unreported host for this species. The woods in which the specimen was taken is an open mature stand, consisting entirely of oaks and hickories, and there is no indication that conifers have ever been present in the wood lot.

8. PORIA SEMITINCTA Peck

This beautiful *Poria,* originally described by Peck[8] in 1879 and recently re-described by the writer, has hitherto been found, to the writer's knowledge, only in four localities in New York State. Its appearance in Pennsylvania is, therefore, of considerable interest. It was collected from the bark of an oak log, near State College, October 5, 1919. The specimens were fresh and on the young subiculum and the growing margin of nature plants the pinkish-lilac color was quite marked. This color has persisted in the dried plants up to the present time. There is also a slight "sweet-acid" odor to the fresh specimens, similar to that in *Polyporus galactinus* Berk. A few scattered cystidia are present in certain areas but often whole sections are without them. In agreement with this, they were reported by the writer as absent in the type specimens of this species but rarely present in another collection preserved at Albany. In the present collection they are 6–9 μ in diameter, project rather strongly, and are slightly incrusted. At first sight it was supposed that this collection might represent the resupinate condition of *Polyporus pargamenus* which on the growing margin is often a similar lavender or lilac color. The plants are too thin for that species, however, the spores are not allantoid but oblong or short-cylindric, the cystidia when present are different, and the hyphae of this plant are quite characteristic. No clamps are present, cross walls are

[8] Bull. N. Y. State Mus. 205–206, pp. 106–108. 1919.

abundant and conspicuous, and most of the numerous branches originate near a cross wall.

9. TREMELLA SPARASSOIDEA Lloyd

Plate 10, fig. 3

On August 25, the writer collected a large *Tremella* on the ground in a deciduous woods near State College. It was assigned tentatively to *Tremella vesicaria* and sent to Mr. C. G. Lloyd under that name. The fungus differs from that species, however, principally in having *acute* erect and *somewhat fimbriate* lobes instead of the large blunt finger-like ones characteristic of *T. vesicaria.* Mr. Lloyd proposes to describe this as a new species as named above. The entire plant formed a mass about 15 cm. in diameter and 10 cm. high and was nearly white in color. In consistency it was more cartilaginous than gelatinous, probably in part accounted for by the dry weather of the few days previous. The basidia are of the usual longitudinally divided type, averaging about 9×12–$14\,\mu$ and with sterigmata up to $20\,\mu$ long. All stages in the development of the basidia are easily found in crushed preparations. The spores are somewhat irregular in shape, from elongate-ellipsoid to broadly inaequilaterally ellipsoid though usually narrower and sometimes slightly apiculate at one end. They measure 8–10×4.5–$6\,\mu$. A specimen is preserved in the Lloyd museum and in the Overholts Herbarium.

In 1910, Gilbert noted and figured a plant from Wisconsin[9] that I have no doubt from his photograph should be referred here. He included it as a variety of *Tremella reticulata,* a name applied by him to the plant here called *T. vesicaria.* My photograph of *T. sparassoidea* shows a striking resemblance to the one published by Gilbert.

10. TREMELLA VESICARIA Fr.

This species was collected in abundance in a grassy woodland pasture in 1915, but had not since been observed until a speci-

[9] Studies on the Tremellineae of Wisconsin. Trans. Wisc. Acad. Sci., Arts, and Let. 16: 1137–1170. 1910.

men was brought in on July 22 of this year. It is undoubtedly to be considered as a rare species although apt to be abundant in local isolated regions.

11. TREMELLODON GELATINOSUM (Scop.) Fr.

About 25 specimens of this unique member of the *Tremellaceae* were collected by the writer on an old hemlock log in Bear Meadows, Center County, Pa., August 30, 1919. The species is apparently rather widely distributed but only rarely collected. The color of the upper surface when fresh varied from nearly white to drab or buffy brown (Ridgway). The largest specimens measured 6 × 7 cm. Another collection from New Hampshire is in the writer's herbarium. Very good illustrations are given in Hard's mushroom book, fig. 405.

12. TRICHOGLOSSUM HIRSUTUM (Pers.) Boudier

Collected in Bear Meadows, Center County, Pa., August 30, 1919. Several hundred individuals were found growing closely associated on a small area of earth, leaf mold, and rotten wood. The largest specimens were about 10 cm. tall and in some the ascigerous portion was somewhat convoluted. The stem and hymenium is beset with a multitude of spines that give a velvety appearance and feeling to the plant. The spores were uniformly 15-septate as described by Durand and measured 130–140 × 5–6 μ.

STATE COLLEGE, PA.

EXPLANATION OF PLATES

PLATE 9

Fig. 1. View of upper surface of a rather young sporophore of *Fomes bakeri*. × ½. In age the pileus may become considerably rimose. Overholts Herb. No. 5529. Photo by E. T. Kirk.

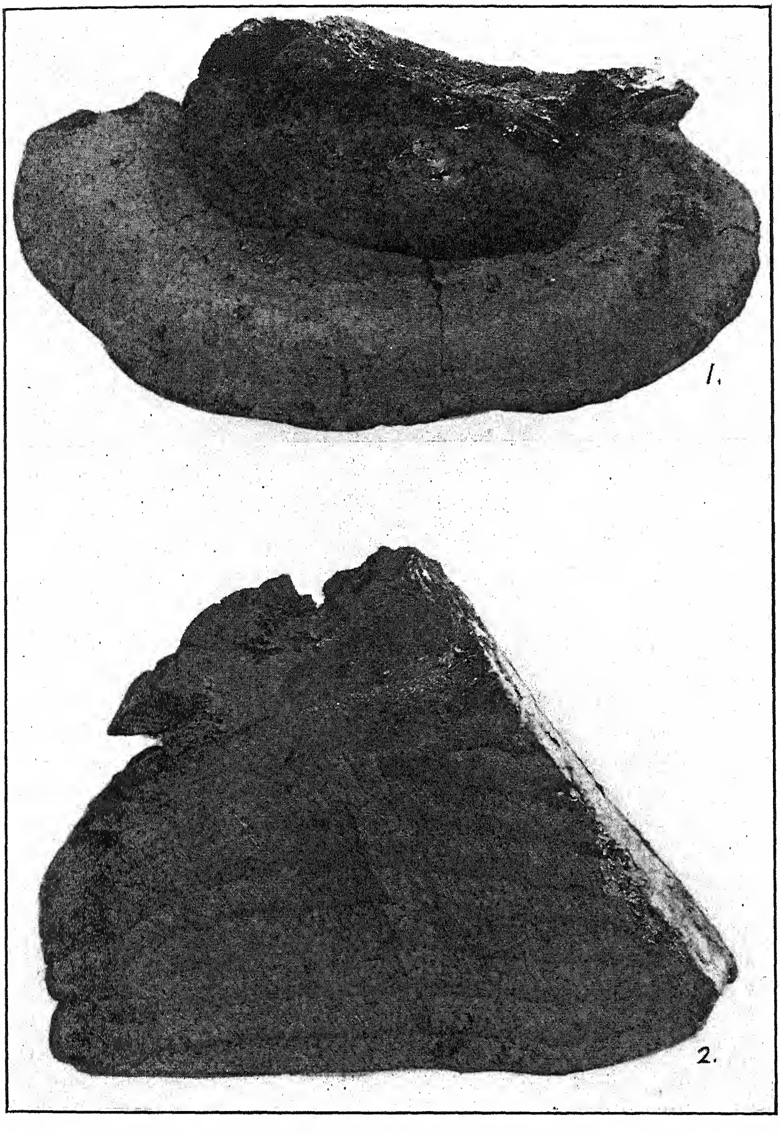
Fig. 2. Lateral view of a vertical section through a perennial sporophore. × 1. Note the conspicuous context and the marked layering of the tubes. Overholts Herb. No. 4174. Photo by E. T. Kirk.

PLATE 10

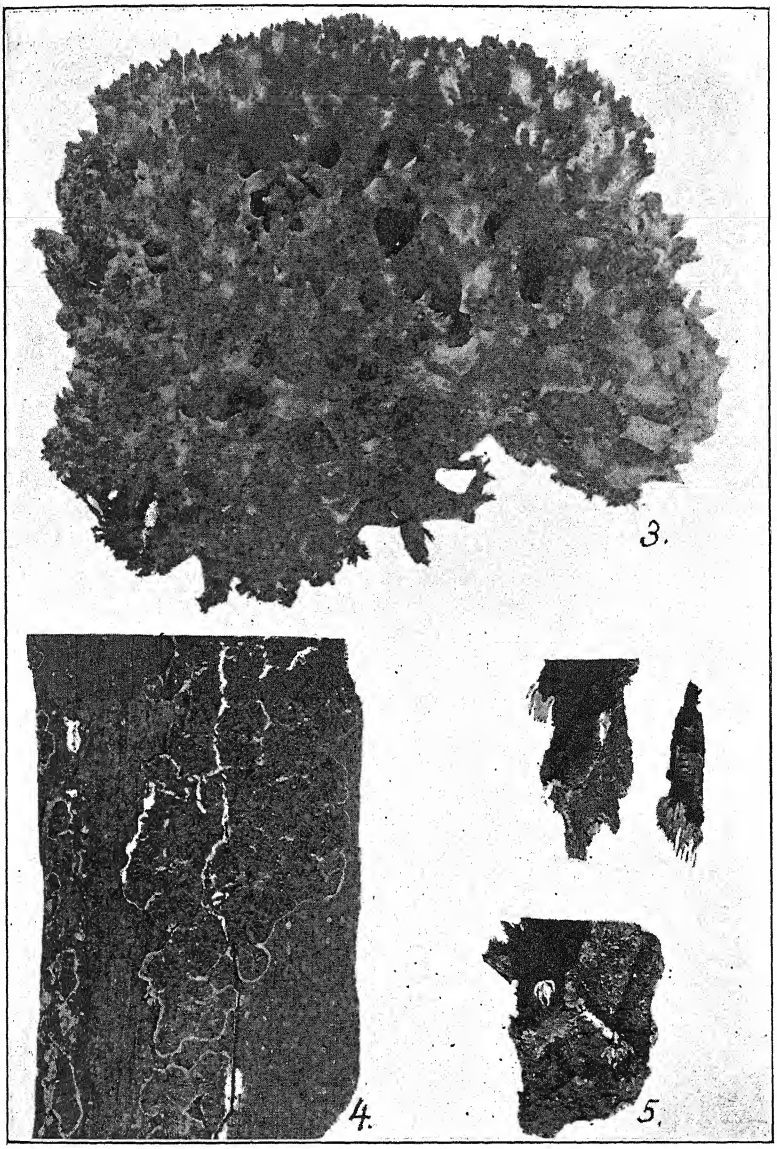
Fig. 3. *Tremella sparassoidea*. View, from above, of the entire plant. × ¾. Type collection, Overholts Herb. No. 5407. Photo by the writer.

Fig. 4. *Merulius aureus*. Specimens largely resupinate. × 1. Overholts Herb. No. 5455. Photo by E. T. Kirk.

Fig. 5. *Mucronella ulmi*. Specimens from bark of living *Ulmus americana*. × 1½. Overholts Herb. No. 3169. Photo by the writer.



FOMES BAKERI (MURRILL) SACC.



3. TREMELLA SPARASSOIDEA LLOYD
4. MERULIUS AUREUS FRIES
5. MUCRONELLA ULMI PECK

RUSTS FROM GLACIER NATIONAL PARK, MONTANA

Paul C. Standley[1]

During the summer of 1919, the writer spent ten weeks in Glacier National Park, under the direction of the National Park Service, for the purpose of securing data concerning the flora of the region. Attention was devoted almost wholly to the flowering plants and vascular cryptogams, but a few of the lower cryptogams were secured incidentally, and a small amount of time was spent in searching specially for rusts. Sixty-one species of these interesting plants were secured, and since they come from an area in which very little botanical collecting has been done, it may be worth while to publish a list of them. The list is particularly deficient in grass rusts, for grasses were not collected, and consequently the rusts that may have existed upon them were likewise neglected.

The writer is under obligations to Dr. J. C. Arthur, who has kindly determined the collections. The specimens are in the U. S. National Herbarium, and duplicates of most of them are in Doctor Arthur's herbarium.

The flowering plants of Glacier Park are of great interest. The flora of the east slope of the Park is similar to that of the central Rocky Mountains, but the flora of the west slope shows a marked relationship with that of the Pacific Coast. Many species of plants, especially of trees, find the eastern limit of their range there, and many plants which are common in Alberta and British Columbia extend into the United States in northwestern Montana, but are rare or absent elsewhere south of the international boundary.

The material collected during the season of 1919 has served as the basis of a popular account of the plants of the Park, to be issued by the National Park Service, and of a technical flora of the region, to be published by the National Museum.

[1] Published by permission of the Secretary of the Smithsonian Institution.

AECIDIUM ALLENII Clinton

I. On *Lepargyrea canadensis* (L.) Greene (15505).

ALLODUS PALMERI (D. & H.) Arth.

I, iii. On *Penstemon ellipticus* Coult. & Fish. (16759).

CALYPTOSPORA COLUMNARIS (A. & S.) Kühn

On *Pseudotsuga mucronata* (Raf.) Sudw. (16902). Dr. Arthur states that this rust has not been reported previously upon *Pseudotsuga.* It occurs usually upon species of *Abies.*

COLEOSPORIUM RIBICOLA (C. & E.) Arth.

II, III. On *Ribes lacustre* (Pers.) Poir. (15903).

COLEOSPORIUM SOLIDAGINIS (Schw.) Thüm.

II. On *Solidago concinna* A. Nels. (16915). ii, III. On *Aster meritus* A. Nels. (18686). III. On *Aster Fremontii* (Torr. & Gray) Gray (18425), and *Aster conspicuus* Lindl. (16935).

CRONARTIUM COMANDRAE Peck

On *Comandra pallida* A. DC. (15944).

GYMNOSPORANGIUM BETHELI Kern

I. On leaves of *Crataegus Douglasii* Lindl. (17844).

GYMNOSPORANGIUM GERMINALE (Schw.) Kern

On fruit of *Crataegus Douglasii* Lindl. (17416) and *Amelanchier alnifolia* Nutt. (17007).

GYMNOSPORANGIUM JUVENESCENS Kern

I. On leaves of *Amelanchier alnifolia* Nutt. (15597).

GYMNOSPORANGIUM NELSONI Arth.

I. On leaves of *Amelanchier alnifolia* Nutt. (17743, 17425, 15159) and *Sorbus sitchensis* Roem. (16533, 18449, 18643, 17034). Almost every plant of the mountain ash had rusted leaves. The yellow spots on the leaflets are conspicuous in early summer, but no aecia were found in 1919 until July 28.

HYALOPSORA CHEILANTHES (Peck) Arth.

On *Cryptogramma Stelleri* (Gmel.) Prantl (17144).

MELAMPSORA ALBERTENSIS Arth.

ii, III. On *Populus tremuloides* Michx. (18732). Seen only about Belton, although aspens are abundant on the east slope of the Park.

MELAMPSORA ARCTICA Rostr.

II, iii. On *Salix Scouleriana* Barr. (18485).

MELAMPSORA CONFLUENS (Pers.) Jackson

II, III. On *Salix Bebbiana perrostrata* (Rydb.) Ball (15699), *S. subcaerulea* Piper (15111, 18805, 18460, 17366), *S. monticola* Bebb? (17686), and *S. Scouleriana* Barr. (15971, 18736, 15969, 15606, 16680).

MELAMPSORA OCCIDENTALIS Jackson

II, III. On *Populus hastata* Dode (18765).

MELAMPSORELLA ELATINA (A. & S.) Arth.

II. On *Cerastium strictum* L. (15752) and *C. beeringianum* Cham. & Schlecht. (17479).

MELAMPSOROPSIS PYROLAE (DC.) Arth.

II. On *Pyrola chlorantha* Sw. (17924), *P. secunda* L. (16038), *P. asarifolia* Michx. (15206), and *Moneses uniflora* (L.) Gray (15241).

PHRAGMIDIUM ANDERSONI Shear

On *Potentilla fruticosa* L. (17360).

PHRAGMIDIUM IMITANS Arth.

II, III. On *Rubus strigosus* Michx. (16085).

PHRAGMIDIUM IVESIAE Sydow

II, III. On *Potentilla Nuttallii* Lehm. (15020, 17739). I. On *Potentilla monspeliensis* L. (15544a).

PHRAGMIDIUM OCCIDENTALIS Arth.

II, III. On *Rubus parviflorus* Nutt. (15196, 17928).

PHRAGMIDIUM POTENTILLAE (Pers.) P. Karst.

On *Potentilla pennsylvanica* L. (17324, 17336).

PHRAGMIDIUM ROSAE-ACICULARIS Liro.

I. On *Rosa Bourgeauiana* Crép. (15711). I, ii. On *Rosa nutkana* Presl (14967). III. On *Rosa gymnocarpa* Nutt. (18862, 17923) and *R. nutkana* Presl (18750).

PUCCINIA ABERRANS Peck

On *Smelowskia americana* Rydb. (16474, 15801).

PUCCINIA ABUNDANS (Peck) Jackson

I. On *Symphoricarpos albus* (L.) Blake (15674).

PUCCINIA ANTIRRHINI D. & H.

Occurring abundantly at Lake McDonald on cultivated snapdragons.

PUCCINIA ARNICALIS Peck

III. On *Arnica latifolia* Bong. (15899).

PUCCINIA ASPERA D. & H.

On *Saxifraga Mertensiana* Bong. (16814).

PUCCINIA ASTERUM (Schw.) Kern

I. On *Aster frondeus* (Gray) Greene (15329, 14968) and *Erigeron macranthus* Nutt. (17978).

PUCCINIA BALSAMORRHIZAE Peck

On *Balsamorrhiza sagittata* (Pursh) Nutt. (15983).

PUCCINIA CIRCACEAE Pers.

On *Circaea alpina* L. (17078, 17937).

PUCCINIA CIRSII Lasch.

On *Cirsium Hookerianum* Nutt. (15705).

PUCCINIA CLEMATIDIS (DC.) Lagerh.

I. On *Thalictrum megacarpum* Torr. (15258, 14944, 15197) and *Halerpestes Cymbalaria* (Pursh) Greene (17622). II, III. On *Elymus glaucus* Buckl. (17962).

PUCCINIA FERGUSSONI B. & Br.

On *Viola palustris* L. (16493).

PUCCINIA FRASERI Arth.

On *Hieracium albiflorum* Hook. (16365).

PUCCINIA HEUCHERAE (Schw.) Dict.

On *Mitella nuda* L. (16492).

PUCCINIA HIERACII (Schum.) Mart.

On *Hieracium albiflorum* Hook. (15188) and *H. columbianum* Rydb. (16663, 18758).

PUCCINIA HOLBOELLII (Hornem.) Rostr.

On *Arabis Lyallii* S. Wats. (16231, 15419, 15838, 18036).

PUCCINIA MESOMEJALIS B. & C.

On *Clintonia uniflora* (Schult.) Kunth (15187).

PUCCINIA PIMPINELLAE (Schum.) Mart.

I, ii, III. On *Glycosma occidentalis* Nutt. (14923, 15927). II, III. On *Osmorrhiza divaricata* Nutt. (18480).

PUCCINIA RHAMNI (Pers.) Wettst.

I. On *Rhamnus alnifolia* L'Hér. (14951, 15260). II, III. On *Calamagrostis canadensis* (Michx.) Beauv. (16868).

PUCCINIA SAXIFRAGAE Schl.

On *Saxifraga rivularis* L. (18044a).

PUCCINIA TARAXACI Plowr.

II, III. On *Taraxacum officinale* Weber (15922, 18757).

PUCCINIA TROXIMONTIS Peck

III. On *Agoseris villosa* Rydb. (16080) and *A. turbinata* Rydb. (16662).

PUCCINIA URTICAE (Schum.) Lagerh.

I. On *Urtica cardiophylla* Rydb. (15237).

PUCCINIA VERATRI Duby.

On *Epilobium anagallidifolium* Lam. (15199, 16104) and *E. alpinum* L. (18024a).

PUCCINIA VIOLAE (Schum.) DC.

III. On *Viola canadensis* L. (15931, 17917).

PUCCINIASTRUM ARCTICUM AMERICANUM Farl.

II. On *Rubus strigosus* Michx. (18247).

PUCCINIASTRUM MYRTILLI (Schum.) Arth.

II. On *Vaccinium membranceum* Dougl. (18745, 18266, 16359), *V. caespitosum* Michx. (18818), and *V. Myrtillus* L. (16361).

PUCCINIASTRUM PUSTULATUM (Pers.) Diet.

On *Epilobium platyphyllum* Rydb. (17974), *E. angustifolium* L. (18775, 18478), and *E. adenocaulon* Hausskn. (16998).

PUCCINIASTRUM PYROLAE (Pers.) Diet.

II. On *Pyrola secunda* L. (18694). Collected also at Iceberg Lake, on *Pyrola minor* L., by Miss Gertrude Norton.

UREDINOPSIS ATKINSONII Magn.

II. On *Athyrium Filix-foemina* (L.) Roth (17918).

UROMYCES GLYCYRRHIZAE (Rabenh.) Magn.

On *Glycyrrhiza lepidota* Nutt. (18833).

UROMYCES HEDYSARI-OBSCURI (DC.) C. & P.

I. On *Hedysarum sulphurescens* Rydb. (16658).

UROMYCES HETERODERMUS Sydow

On *Erythronium grandiflorum* Pursh (16182, 18086).

UROMYCES INTRICATUS Cooke

I, II. On *Eriogonum Piperi* Greene (15595, 15980).

UROMYCES JUNCI (Desm.) Tul.

I. On *Arnica mollis* Hook. (16937).

UROMYCES POROSUS (Peck) Jackson

I. On *Vicia americana* Muhl. (15123).

UROMYCES SILENES (Schl.) Fckl.

III. On *Silene multicaulis* Nutt. (16586).

UROMYCES TRIFOLII (Hedw. f.) Lev.

II. On *Trifolium repens* L. (18863) and *T. hybridum* L. (18864).

UROPYXIS SANGUINEA (Peck) Arth.

II. On *Berberis repens* Lindl. (15189, 18872).

U. S. NATIONAL MUSEUM,
WASHINGTON, D. C.

NEW OR NOTEWORTHY NORTH AMERICAN USTILAGINALES

H. S. JACKSON[1]

TILLETIACEAE

TILLETIA SECALIS (Corda) Kühn, Bot. Zeit. 34: 471. 1876

Uredo Secalis Corda, Oekon. Neuigk. und Verh. 1: 10. 1848.

While long known as of rare occurrence in central Europe, the bunt of rye has apparently not been reported in North America. Recently, in connection with a study of the smuts of New York state, the writer had occasion to examine a specimen from the Underwood herbarium at the New York Botanical Garden, which bears the following data: "Ustilago on Rye, Syracuse, N. Y., June, 1892, L. M. Underwood." This examination revealed the fact that the sori were confined to the grains and the spores were beautifully reticulated, suggesting those of *T. Tritici.* A comparison with European material (Vestergren, Micro. rario selecti *1474*) and with published descriptions suggested that the collection made by Underwood might properly be referred to *Tilletia Secalis.*

While resembling *T. Tritici,* and by some writers included with it[2] this species differs in certain characters. The sori are very much the shape of the normal rye grain but somewhat shorter and broader. The reticulations are 1.5–2.5 μ high and 3–4 μ wide, while in *T. Tritici* they are described as 1 high by 2–4 μ wide. The spores of *T. Secalis* averages slightly larger than in *T. Tritici.*

The New York collection consists of a single somewhat abnormal head. Some of the lower spikelets have developed long internodes so that the head appears much broader at the base than in the normal form. On account of this abnormal appearance and in order to make sure that no mistake in the identification

[1] Contribution from the Botanical Department of the Purdue University Agricultural Experiment Station.

[2] Cf. Schellenberg, Beiträge Krypt. Schweiz 3^2: 90–94. 1911.

of the host had been made the specimen was submitted to Prof. A. S. Hitchcock and Mrs. Agnes Chase, who reported that the specimen was without doubt cultivated rye. Dr. C. H. Leighty, of the Office of Cereal Investigations, also examined the specimen and reported that there was no evidence that it could represent a rye-wheat hybrid.

On account of the importance of rye as a cereal crop in this country the existence of this old collection is considered worthy of note. While the validity of *T. Secalis* is questioned by some authorities, it seems best for the sake of emphasis to record the collection under the above name.

TILLETIA HOLCI (West.) Rostrup, Bot. Tids. **22**: 256. 1899

Polycystis Holci Westend, Bull. Acad. Belg. II. **11**: 651. 1861.
Tilletia Rauenhoffii Fisch. de Waldh. Aperçu Syst. Ust. 50. 1877.

This very distinct species, long known in Europe, has not been reported for North America. It occurs on species of *Notholcus* and collections have been made by the writer in Oregon an *Notholcus lanatus* as follows:

Elk City, August 20, 1914, *1378*; Yaquina, July 17–20, 1915, *3017*.

The sori are obovoid, 1.5–2 mm. in length and occur in the ovaries nearly concealed by the glumes. The spores are chiefly globoid, 24–26 μ in diameter, occasionally ellipsoid, 24–26 by 26–30 μ, the wall cinnamon-brown, beautifully reticulated (measurements include the colorless reticulations which are 2.5–3 μ high). This smut was very abundant at Yaquina in 1915 and was collected in considerable quantity. All the ovaries in infected heads appear to be smutted.

ENTYLOMA COLLINSIAE Harkness, Bull. Cal. Acad. Sci. **1**: 40. 1884

According to Clinton[3] this species is reported only on *Collinsia bartsiaefolia* from the type locality, Mt. Tamalpais, California. The following collections made by the writer in western Oregon, besides extending the range add two new hosts.

[3] N. Am. Flora 7: 63. 1906.

On *Collinsia grandiflora* Dougl. Mary's Peak, Benton Co., May 21, 1915, *3413*.

On *Collinsia tenella* (Pursh) Piper. Corvallis, Benton Co., April 8, 1914, *1696*, April 11, 1915, *3411*.

Urocystis Trillii sp. nov.

Sori hypophyllous on yellowish spots, subcostal, or caulicolous, round or oval, 0.5–1.5 mm. across, scattered or more commonly gregarious in more or less circular groups 5–10 mm. across, caulicolous sori often elongated, reaching 1 cm. in length, opening tardily and exposing the purple-black spore mass; ruptured epidermis cinereous and conspicuous; spore balls chestnut-brown, globoid, 24–50 μ, or ellipsoid, 30–40 by 50–70 μ, occasionally smaller; sterile cells subgloboid or polygonal, 5–9 μ, wall golden-brown, 1–1.5 μ thick, collapsing with age; spores subgloboid, ovoid or polyhedral, few to many in a ball, 3–20, rarely only one or two, mostly 10–15 μ, wall 2–3 μ thick, chestnut-brown.

On *Trillium chloropetalum* (Torr.) Howell. N. W. Corvallis, Benton Co., Oregon, April 13, 1912, F. D. Bailey, *1066*, May 19, 1912, F. D. Bailey, *1094*, April 7, 1914, *1811*, April 11, 1915, *3420*, May 1, 1915, *3408*, May 6, 1919, *3437* (type); Mary's River, Benton Co., June, 1911, *1097*.

Unless otherwise noted the collections were made by the writer.

This smut is very characteristic and conspicuous. The sori on the leaves are usually grouped together, the individual sori roundish or oval, usually 0.5–1.5 mm. across. On the veins and stems the sori are often confluent and quite large, reaching 1 cm. or more in length. With one exception the collections were made in one spot in low, rich land along a stream. The smut appeared in abundance each year.

UROCYSTIS ORNITHOGALI Koern.; Fisch. de Waldh. Aperçu Syst. Ust. 41. 1877

This species, occurring in Europe on *Ornithogalum*, has been more commonly referred to *U. Colchici* (Schlect.) Rab., but is considered distinct by Schellenberg[4] in his recent treatment of the smuts of Switzerland. The writer is inclined to agree with this

[4] Beiträge Krypt. Schweiz 3^2: 139. 1911.

view and to assign to *U. Ornithogali* collections on *Quamasia* made in Indiana and Oregon as follows:

Quamasia hyacinthina (Raf.) Britton. Lafayette, Tippecanoe Co., Indiana, May 30, 1907, F. Vasku; May 22, 1916, H. S. Jackson; May, 1917, G. N. Hoffer.

Quamasia quamash (Pursh) Coville. N. W. of Corvallis, Benton Co., Oregon, April 7, 1914, H. S. Jackson, *1969*; May 1, 1915, H. S. Jackson, *3409*.

According to this treatment, the smut on Liliaceous hosts belonging to the tribe Scilleae, including besides the American *Quamasia*, species of *Muscaria, Ornithogalum* and *Scilla* in Europe, would be assigned to *U. Ornithogali*, while *U. Colchici* would include the European form on *Colchicum autumnale*. The writer is not able to express an opinion as to whether the form on Convallariaceae in Europe and America is properly assigned to either of the above species, as sufficient material has not been available for study. Clinton[5] has assigned specimens on *Salamonia* and *Vagnera*, collected in Iowa and Montana, somewhat doubtfully to *U. Colchici*.

U. Ornithogali differs from *U. Colchici* chiefly in the widely different character of the sorus, the size of the spores, and the character and wall color of the surrounding layer of sterile cells. In the former the sori are elliptical, commonly half as broad as long, the spore balls consist usually of one, rarely two spores, which are 18–22 μ in diameter, and the sterile cells form a firmly united unbroken spore covering, the walls of which are cinnamon-brown. In the latter the sori are linear, often ten or more times as long as broad; the spore balls consist of one to two, rarely three spores, which are 14–20 μ in diameter; the sterile cells with light cinnamon-brown walls form a loose often interrupted layer over the spores.

TUBERCINA TRIENTALIS Berk. & Br. Ann. Mag. Nat. Hist. II. 5: 464. 1850

In North America this species has apparently been reported only from Alaska on *Trientalis arctica*. Three collections have

[5] Bost. Soc. Nat. Hist. Proc. 31: 452. 1904; N. Am. Flora 7: 57. 1906.

been made in Benton County, western Oregon, and are represented in the herbarium of the Oregon Agricultural College and that of the writer. All were made on *Trientalis latifolia* as follows: Philomath, April 20, 1912, H. S. Jackson and F. D. Bailey, *1093*; Corvallis, May 19, 1912, F. D. Bailey, *1098*, April 8, 1914, H. S. Jackson and F. D. Bailey, *1695*.

All three collections are ample and show both the conidial and chlamadospore stages. In our specimens the chlamadospore sori are confined to the stems and petioles. The conidial stage usually covers the entire upper surface of the leaf, though occasionally occurring in isolated pustular patches.

USTILAGINACEAE

Cintractia minor (Clinton) comb. nov.

Cintractia axicola minor Clinton, Jour. Myc. 8: 143. 1902.

The writer is of the opinion that this *Cintractia* is deserving of specific rank. It not only shows constant morphological differences from *Cintractia axicola* (Berk.) Cornu but occurs on a different host genus. Seven collections have been examined and the characters found to be constant. All are on *Cyperus Grayii* Torr. The first collections of which we have any knowledge were made at Atlantic City, New Jersey, Sept., 1884, by E. W. D. Holway, and Sept. 8, 1884, by J. C. Arthur. A collection was made by J. J. Davis at Sandy Hook, N. J., Aug., 1887, and by J. L. Zabriskie, Aug. 15, 1887. J. B. Halsted also found it at Sandy Hook, N. J., Aug. 15, 1889, and his collection was distributed in Ellis & Everhart's North American Fungi as no. *2423* (type of *C. axicola minor* Clinton). J. C. Arthur made a collection at Rockaway Beach, Long Island, Aug. 14, 1887. The writer also collected this species Oct. 4, 1907, at Selbyville, Delaware.

In this connection it is worthy of note that a typographical error has been made in the citation of Sandy Hook, New York, as the type locality. The printed label on the specimens distributed in Ellis & Everhart's North American Fungi *2423* does give Sandy Hook, "New York," as the place of collection. This is, however, obviously an error for New Jersey as is shown by

the data on the original specimen in the Ellis collection at the New York Botanical Garden, which was evidently communicated to Mr. Ellis by Dr. Halsted. The distribution by states as now known to the writer is New York, New Jersey and Delaware.

This species under discussion is easily separated from *Cintractia axicola* by the smaller spores, which measure 10–13 μ, while in *C. axicola* the spores are 12–18 μ. The effect upon the host is similar.

SOROSPORIUM SAPONARIAE Rud. Linnea 4: 116. 1829

This is the type species of the genus and has been reported from North America, so far as can be learned, only from Utah, on *Stellaria Curtisii* Rydb. and *Silene Menziesii* Hooker, by Garrett,[6] and from New York on *Cerastium arvense* by Peck.[7] The writer has recently examined specimens as follows, adding three new hosts for North America and extending the distribution to include Nevada and Colorado:

On *Cerastium oreophilum* Greene, Golden, Colorado, May, 1914, E. Bethel.

On *Silene Watsoni* Robinson, near Mt. Rose, Nevada, July 21, 1918, N. F. Petersen, *362*.

On *Stellaria Jamesiana* Torr., Golden, Colorado, June 12, 1905, E. Bethel.

Thecaphora Iresine (Elliott) comb. nov.

Tolyposporium Iresine J. A. Elliott, Mycologia 11: 88. 1919.

In the fall of 1918 Mr. C. C. Deam, of Bluffton, Indiana, sent to the writer, among other parasitic fungi, an interesting smut on *Iresine paniculata* (L.) Kuntze, which he had collected Sept. 21, 1918, in a dried up wooded slough about one half mile south of Half Moon Pond, which is about ten miles southwest of Mount Vernon in Posey County, Indiana. (Deam, no. 26651.)

This was at once recognized as a species of *Thecaphora* and an examination of the literature revealed that only one species of this genus was known in North America on Amaranthaceae;

[6] Garrett, A. O., Mycologia 2: 226. 1910; 6: 240. 1914.

[7] Peck, C. H., Bull. N. Y. State Museum 131: 27. 1909.

namely, *Thecaphora Thornberi* Griffiths.[8] The specimen on Iresine, while agreeing in general with the description of that species, seemed to differ in important characters. A definite decision with reference to the relation of the two forms was therefore reserved till the type of *T. Thornberi* could be examined. Through the kindness of Dr. Griffiths two collection of his species, one of which was the type, were furnished for study.

The *Iresine* smut is evidently very closely related to *T. Thornberi* but differs in several important respects. The sori, while involving the ovaries, are not usually confined to them, as described for *T. Thornberi,* but are indefinite, involving the ovaries and the perianth of single flowers or groups of flowers and also occasionally the rachis. The spore balls are much smaller in the species under discussion, measuring 40–75 μ in globoid balls, reaching 90 μ in occasional ellipsoid balls, while in *T. Thornberi* the globoid balls are 80–115 μ in diameter, reaching 145 μ in the ellipsoid ones. The spores are somewhat larger and the markings more prominent than in *T. Tornberi.*

The followng description was drawn up as a result of this study:

Sori localized in the inflorescence, involving the ovaries and perianth of one or a group of flowers, often involving the rachis, forming irregular galls 0.3–3.5 cm. long, enclosed by a firm grayish-green membrane, which ruptures irregularly, exposing the reddish-brown spore mass; spore balls solid, subsphaeroid, 40–75 μ, or ellipsoid, 50–70 by 60–90 μ, light chestnut-brown, composed of many, 15–70, spores; spores variable in shape, irregularly polyhedral, prismatic or oblong, 12–20 by 25–32 μ; inner wall thin, 1–1.5 μ, colorless or pale cinnamon-brown, smooth; exposed wall 2–4 μ thick, darker in color with prominent verrucose-rugose markings.

After this study was finished, but before the present paper was completed, the species was described as *Tolyposporium Iresine* from the same collection (Deam, 26651) by Dr. J. A. Elliott (l. c.). The species, however, obviously belongs to *Thecaphora* rather than *Tolyposporium* and this transfer is therefore made above. The author evidently failed to take into account the

[8] Bull. Torrey Club 31: 88. 1904.

existence of the very closely related *T. Thornberi.* Our description is somewhat at variance with the one previously published. The sori in our part of the type collection, which is fairly ample, are not confined to the ovaries and the spore balls do not appear to be hollow, nor do we find any evidence that the cells of the spore balls adhere "by folds of their outer . . . membrane."

TOLYPOSPORIUM JUNCI (Schroet.) Woron. Abh. Senck. Nat. Ges. **12**: 577. 1881.

Sorosporium Junci Schroet. Abh. Schl. Ges. Vat. Cult. **1869–1872**: 6. 1872.

This species is the type of the genus and occurs rather rarely in various parts of Europe, but has evidently not been reported from North America. The writer has made two collections in Oregon, both on *Juncus bufonius* L., one at Corvallis, Benton Co., July, 1910, and the other at Garden City, Multnomah Co., Aug., 1909, *1807*. The fungus is described as attacking the ovaries the stalks and also occurs at the base of the plant. In our specimens the infection occurs most commonly at the nodes, affecting the host somewhat similarly to *Cintractia axicola* on *Fimbristylis,* though often occurring at the base of the stalks. The spore mass is black, composed of spore balls of variable size and shape, 10–50 μ or more and composed of few to many rather small, irregular spores, 7–14 by 10–18 μ. The exposed spore wall is chestnut-brown and minutely verrucose.

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ANOTHER NEW TRUFFLE

W. A. Murrill

In the last number of *Mycologia,* Miss Gilkey described two new American species of truffles, *Tuber canaliculatum* and *T. unicolor,* the latter based on material recently collected in the vicinity of New York City by the use of a dog trained in Europe. After working over this New York material, Miss Gilkey examined and carefully compared with it some specimens collected by Dr. Shear in Maryland twenty years ago, and pronounced them similar but specifically distinct.

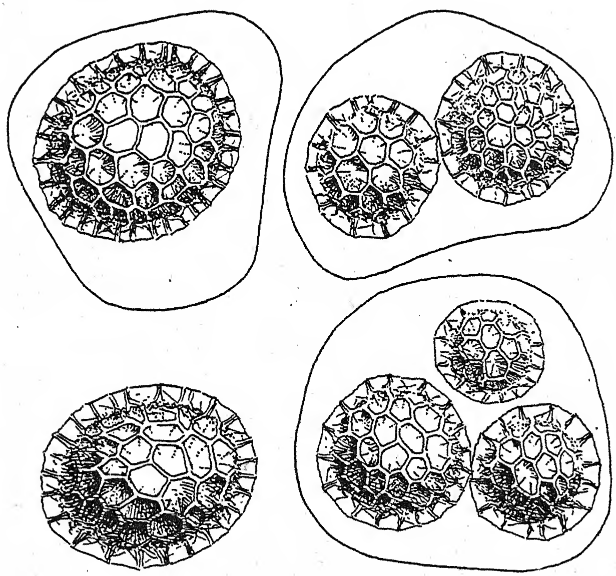

Fig. 1. Asci and spores of *Tuber Shearii.* × 600.

It therefore becomes my duty and privilege (since Dr. Shear seems too diffident) to publish another new truffle from the eastern United States; — and the task is an extremely easy one. Dr. Shear collected the specimens, made the drawing here published, and sent me his correspondence with Dr. Harkness

and Miss Gilkey; while the critical study and comparison was made by Miss Gilkey, whose results are freely incorporated. The description was originally drawn by Dr. H. W. Harkness, of California, in December, 1899, shortly before his death, but his measurements and terms have been somewhat changed.

Tuber Shearii Harkness, sp. nov.

Ascocarp very small, subrotund or slightly elongate; surface smooth, creamy-buff; gleba drab; veins minute; asci many, subglobose, 50–70 μ in diameter, 1–3-spored; spores globose or subglobose, dark-brown, alveolate, minutely reticulate beneath the alveoli, 28–49 μ in diameter; alveoli 9–10 $\times$ 5–6 μ across diameters.

Type collected under *Pinus inops* in Takoma Park, Maryland, October, 1899, *C. L. Shear.* The specimens sent to Dr. Harkness could not be found, but Dr. Shear still had a portion of the original collection and this was sent to Miss Gilkey for examination. Under date of February 14, 1920, she wrote me as follows: "After having very carefully compared the co-type of *Tuber Shearii,* which Dr. Shear sent me last week, with material of *T. unicolor,* I do not consider the two plants similar. *T. Shearii* has much larger spores with distinctly different sculpturing and color and these differences are constant for all the material studied. Other than spore differences probably occur in these two species, but since all my material of one was dried while the other is in formalin, and since you wished an immediate answer, I have not yet taken time to investigate further, particularly since the constant differences in spores are sufficiently distinctive, in my judgment, to separate the two."

NEW YORK BOTANICAL GARDEN.

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor*]

Readers of MYCOLOGIA are invited to contribute to this department personal news items and notes or brief articles of interest to mycologists in general. Manuscript should be submitted before the middle of the month preceding the month in which this publication is issued.

Dr. Carl Hartley, formerly pathologist in the Office of Forest Pathology Investigations, Bureau of Plant Industry, has resigned to take a position in the Institute for Plant Diseases at Buitenzorg, Java.

Dr. W. H. Rankin, for five years assistant professor of plant pathology in the New York State College of Agriculture at Cornell University, has been appointed officer-in-charge, Field Laboratory of Plant Pathology, St. Catharines, Ontario, in the Canadian Department of Agriculture.

Mr. Emery D. Eddy, who has been engaged during the past year in the investigation of diseases of market vegetables for the Department of Agriculture, recently resigned his position to take up commercial work.

Professor Guy West Wilson has returned to the department of biology in Upper Iowa University, Fayette, Iowa. While at Clemson College in South Carolina, he collected a number of interesting fungi, an account of which will soon appear in MYCOLOGIA.

Oak mildew, according to Poeteren, may be effectively checked for an entire season by a single application of lime-sulphur spray, if used when the mildew begins to develop vigorously.

A new and effective disinfectant for pear blight is said by Reimer to be a 10 per cent. solution of commercial formaldehyde

in water, which should be applied to all tools used and all wounds made in connection with blight work in pear orchards.

Silver leaf of fruit trees, especially injurious to choice varieties of the plum, has become a serious scourge in some parts of England. The only remedy seems to be the speedy and thorough removal of all affected trees or parts of trees, as is done in the case of pear blight.

Fomes lucidus is parasitic on a number of trees in Barbados, according to Nowell, including lime trees, *Pithecolobium saman, P. unguis-cati, Caesalpinia coriaria,* and species of *Acacia,* the trunks of which are usually attacked at the center.

Whitten has found that winter injury to the buds of fruit trees in Missouri, where they are liable to develop too early and be killed by the frost, may frequently be prevented by spraying with whitewash, which reflects the heat of the sun and thus retards development. Anything that will maintain late growth in the fall will also tend to delay the flowering period the following spring.

Snapdragon rust, according to Peltier, has been in California since 1879 and in Illinois since 1913. It can not be controlled by Bordeaux or similar fungicides, but the conditions under which snapdragon plants are grown must be carefully watched. Watering the plants from below checks the ready dissemination and germination of the spores, while propagation from seed would probably prevent the disease entirely, since the rust spores are not carried on the seed of the snapdragon.

Patouillard, the famous French mycologist, has observed *Ustulina vulgaris* to be the cause of a fatal disease of the linden. The fungus attacks the trunk at the surface of the ground, spreads over it for a foot or more, penetrates the sapwood and heartwood, and kills the tree apparently by parasitic action.

A disease of the walnut tree in France is said by Paravicini to be due to the attacks of *Favolus europaeus,* one of the common polypores ordinarily considered non-parasitic. According to this investigator, the fungus enters the trunk through wounds and is frequently found associated with other fungi.

Professor E. T. Bartholomew, of the Department of Botany of the University of Wisconsin, has accepted a research professorship in the Graduate School of Tropical Agriculture at Riverside, California, in connection with the University of California. His special work will be the investigation of the diseases of lemons and other citrus fruits.

Professor H. M. Fitzpatrick, of Cornell University, has made arrangements to teach in the summer school of the University of Michigan. He has just completed a monograph of the Corynelliaceae, which will appear in part in the July number of *Mycologia.*

Tyrosin in the fungi is discussed by C. W. Dodge in the *Annals of the Missouri Botanical Garden* (6: 71–92. 1919). He investigated the chemistry of the tyrosinase reaction in certain species that turn blue or black on exposure to the air, and found: "(1) that the tyrosinase reaction is not a deamination, although it is possible that deaminases may exist in the same organism with tyrosinase; (2) that the tyrosin molecule is synthesized into a larger, more complex molecule, in which part of the carboxyl groups is either split off as carbon dioxide, or more probably bound in the molecule so that it will not react with alkali."

"Études sur la biologie et la culture des champignons supérieurs" is the title of a paper of 116 pages and many illustrations published by Monsieur G. Boyer at Bordeaux in 1918. Cultures from spores were usually unsatisfactory, so he was forced to use portions of the hymenophore. The best medium seemed to be

a decoction from carrots solidified with gelose. Mycelium obtained from spores of *Morchella* was vigorous, but no fruit-bodies were formed, probably owing to the necessity of a mycorhizal host previous to ascocarp formation. He found that saprophytic fungi grew readily on culture media, but this was not true of mycorhizal forms associated with certain trees in a symbiotic relationship.

An illustrated article by Hartley and Hahn on the diseases of the quaking aspen, probably the most widely distributed tree of our American forests, appeared in *Phytopathology* for March, 1920. After a discussion of fungi attacking the leaves, twigs, and trunk, the authors conclude with the following summary: "Observations have shown quaking aspen in certain areas to be unusually subject to disease; trunk cankers of unknown origin seem to be especially important factors in shortening the life of the trees. *Fomes igniarius* is also an important factor in causing premature death of aspen in the Pike's Peak region. Interesting but less important diseases are (1) a twig blight suggesting in appearance the fire blight of pear; (2) a leaf disease due to *Sclerotium bifrons*, E. & E., distributed from the Rocky Mountains to New England and also attacking Lombardy poplar but not *Populus grandidentata;* and (3) a rapidly spreading bark trouble which kills cuttings."

A widespread leaf-spot disease of the German Iris caused by *Heterosporium gracile,* or *Didymellina Iridis,* is discussed at length by W. B. Tisdale in *Phytopathology* for March, 1920. This disease seems to occur wherever the susceptible, broad-leaved species of Iris are grown, having been reported from Wisconsin, New York, California, England, and elsewhere. The fungus overwinters in the mycelial stage in the dead leaves. Perithecia develop early in the spring, but do not always produce asci, apparently on account of the weather conditions. Sterile perithecia bear conidia on the apex. An abundant crop of conidia, always present early in the spring, serves as the chief source

of primary infection. The only mode of penetration found during the experimental work at Madison was through the stomata. The removal of dead infected leaves before the young leaves appear in the spring promises to be a successful means of control.

"Short Cycle Uromyces of North America" is the title of an illustrated paper by G. R. Bisby in the *Botanical Gazette* for March, 1920. The characters, relationships, life history, cytology, hosts, taxonomy, and bibilography of this group of rusts are discussed in a rather comprehensive way. No new species are described. The following conclusions are drawn: "Eleven species of *Uromyces* possessing only telia and pycnia, or telia alone, are now considered to be present in North America. These are found especially in the higher and warmer portions of the continent, and occur upon seven widely separated host families. While these rusts form a group agreeing as to life cycle and as to the 1-celled character of the teliospores, it is not considered that phylogenetic interrelationship is thereby shown, morphological evidence indicating rather that the relationship of a species of these rusts is found in other rusts (of various life cycles and with 1- or 2-celled teliospores) upon the same or related hosts. Indeed, as indicated under *Uromyces heterodermus,* a group of hosts may bear a number of rusts of various life cycles, belonging to *Puccinia* and *Uromyces,* widely distributed geographically, yet all showing a certain unanimity of morphological characters, especially in the telial stage."

"Dothidiaceous and Other Porto Rican Fungi," by F. L. Stevens, with 2 plates and 3 figures in the text, appeared in the *Botanical Gazette* for March, 1920. One new genus, *Halstedia,* and the following fifteen new species were described: *Uleodothis Pteridis, Dothidella portoricensis, D. flava, Catacauma Ocoteae, C. palmicola, C. Gouaniae, Phaedothopsis Eupatorii, Halstedia portoricensis, Dimerina monenses, Gloniella rubra, Guignardia Justiciae, G. Tetrazygiae, G. Nectandrae, Zignoella algaphila,* and *Phyllosticta bonduc.*

At a recent meeting of the Botanical Society of America at St. Louis, a request was presented to the Council of the Society for the establishment of a Mycological Section. The form of this request was as follows:

"We, the undersigned members of the Botanical Society, consider it highly desirable and necessary, for the better promotion of mycological research and the more efficient presentation of papers on fungi, that a separate section be established and a segregated program be given at our annual meetings.

"Therefore, we ask the Council of the Botanical Society to institute at this time a new section, to be called the Mycological Section, to include papers on fungi in all phases, in so far as these do not conflict with the interests of the American Phytopathological Society."

The Council granted the request and, at the instance of Secretary Schramm, a meeting of the signers of the memorandum was called and Dr. C. H. Kauffman was elected chairman of the new Section.

PIER ANDREA SACCARDO

Professor Saccardo, so well known to mycologists, died at Padua, Italy, February 12, 1920. Born at Treviso, April 23, 1845, he was assistant in the Botanical Institute of the University of Padua, 1866–72; professor of natural history in the Technical Institute at Padua, 1869–79; became professor of botany and director of the botanic garden of the University of Padua in 1880; and retired in later years as professor *emeritus*. For a list of his publications, see Lindau & Sydow's "Thesaurus."

The writer has visited him at Padua and also at Selva, where one of his summer homes was located, and always found him busy with plans regarding his "Sylloge." Shortly before his death, he sent in a paper for publication in *Mycologia*, which will appear in the next number. The passing of Saccardo adds another distinguished name to the heavy toll of mycologists taken during the past few years.

W. A. MURRILL

A MYCOLOGIST IN THE MAKING

An excellent collection of Ohio fungi was recently sent to me for determination by Mr. W. R. Lowater, a beginner in this field, and the letter accompanying it is so good that I will quote a few paragraphs from it to encourage other beginners:

"For a person like myself, without even a common school education, to attempt unaided the collection of the fungous flora of a certain locality, must seem to a person like yourself as rank impertinence, or at best unwarranted presumption. But I beg of you to suspend judgment. This is not the first great task I have undertaken, nor by any means the greatest. Against all handicaps, I have pitted my usual persistence and self-reliance, supplemented by a love for the chosen task; and, if the progress I have made in the last two years is any criterion of future advancement, you will have little cause ever to feel ashamed of your protégé,—if I may so call myself.

"Furthermore, the university student has the advantages of botanical libraries, lectures, technical instruction, herbaria, and scientific apparatus, while I have had none of these, and have had to grope my way. Only recently have I been placed in a position to buy literature on the subject, and I am slowly acquiring such apparatus as my limited means will allow.

"All that I desire is a start. Should you feel constrained to say, 'Don't! The task is too great for you—you are not qualified for it,' I will only the more solicit your patience. Should the bungling descriptions I have prepared grate on your 'scientific' nerves, I hope that a consideration of the conditions under which I have worked will prevent you from treating the entire matter with levity."

Everyone must bow, sooner or later, to determination and devotion; and mycology needs earnest workers in all sections of the country. Specimens well collected and preserved are always valuable, whether the collector has studied Latin or not.

W. A. MURRILL

KAUFFMAN'S AGARICACEAE

"The Agaricaceae of Michigan," by Dr. C. H. Kauffman, which appeared in 1919, is a stupendous piece of work splendidly done. No one who has not tried something of the kind can realize what such an undertaking means. The detailed descriptions of fresh specimens as they accumulated during the years; their determination from scattered types and inadequate literature; the photographs and drawings; the careful microscopic work; the serious questions relative to poisonous species;—all these and more have been the task of Dr. Kauffman.

The volume of text contains 924 pages, most of which are required for the descriptions of the 884 species listed for Michigan. The introductory remarks include discussions regarding the structure, habit of growth, distribution, collection, and classification of the gill-fungi; while the volume closes with a glossary and bibliography by the author and a lengthy paper by Dr. O. E. Fischer on mushroom poisoning. The second volume consists of 162 full-size plates illustrating in black and white a total of 185 species, many of which have not been illustrated elsewhere.

The new species published in this work, not to mention the new varieties, are thirty in number, a list of which follows. They are to be credited to Dr. Kauffman unless otherwise indicated:

Russula ochraleucoides, R. subpunctata, R. amygdaloides, Hypholoma peckianum, Psilocybe larga, Cortinarius iodeoides, C. velicopia, C. rubens, C. elegantioides, C. aggregatus, C. sphaerosperma, C. purpureophyllus, C. virentophyllus, C. subpulchrifolius, C. subtabularis, C. mammosus, C. impolitus, C. subrigens, Inocybe lanotodisca, I. glaber, Hebeloma simile, Galera bulbifera, G. cyanopes, Crepidotus stipitatus, Eccilia pirinoides, Amanita chrysoblema Atk., *Lepiota fischeri, Pleurotus albolanatus* Pk., *Tricholoma laticeps,* and *Clitocybe praecox.*

W. A. MURRILL

Phytopathology for January, 1920, contains an article on Dr. Farlow, by G. P. Clinton; one on the potato mosaic disease, by H. M. Quanjer; and abstracts of the phytopathological papers presented at the recent meeting in St. Louis.

In reporting on the potato wart survey for 1919, Dr. Lyman states that the disease was found in small amounts in six villages

in western Pennsylvania and in two villages in northern West Virginia, all being in the soft-coal section, except one of the West Virginia localites. Apparently no other extensive area of infestation exists at all comparable to the Hazleton district, but undoubtedly there are other undiscovered isolated points of infestation in regions out of touch with modern agriculturists. These can be brought to light only by further intensive survey.

"Wood-destroying fungi in pulp and paper mill roofs" was the title of a paper presented by Mr. R. J. Blair, which was abstracted as follows: When the roof of a paper mill is built of wood moisture in the air permits the development of wood-destroying fungi in the timber. Rapid rotting takes place and it is often necessary to renew the timber after six or eight years' service. The roofs of eighty of the Canadian paper mills have been examined to find the different types of construction used and the services secured from each. The common faults in every case are that moisture enters the spaces between the planks and reaches their upper side, where it condenses, causing a moist condition of the planks during prolonged periods and at the same time the wood is of a non-durable species. There is no evidence that other species of fungi than three of those mentioned last year in connection with the cotton mill roofs, *Lentodium tigrinum, Lenzites trabea,* and *Poria xantha,* cause these losses. The remedy for such timber decay lies in a combination of four factors, which need consideration when the roof is being built. These are the use of wood which resists decay, ventilation which carries away the moisture, liberal dry-air heating, and a heat-insulating layer placed on the upper side of the planks.

Dr. J. C. Arthur reported that there were two destructive rusts ready to invade the United States at the first opportunity. A rust on peanuts has long been prevalent in South America. In Trinidad and the nearby islands of the Antilles it is a great menace to the crop, often covering every leaf on the plants with a heavy powder of urediniospores. No successful method of controlling the rust has yet been found. A rust on potatoes and tomatoes, comparable in its life history and behavior with the hollyhock rust, has recently come to light in Costa Rica and Ecuador. The possibilities for its spread and harmfulness de-

serve serious attention. Neither this rust nor the preceding one has yet been reported from any United States possession.

The biology of *Fomes applanatus* is ably and comprehensively treated by J. H. White in the *Transactions of the Royal Canadian Institute* 12: 133–174. *pl. 2–7.* 1919. Two of the most important results obtained relate to the discharge of spores and to the parasitic nature of the fungus. These are summarized by the author as follows:

"Spore discharge is enormous and continues for by far the longest period recorded for fungi. It is continuous day and night for about six months—visible from vigorous fruiting bodies as spore clouds. Buller, from a count estimate in the case of *Polyporus squamosus,* a form which also exhibits spore clouds, concluded that at least 1,700,000 spores were discharged from one tube in three days. A similar calculation with *F. applanatus* gave the incomprehensible number of 30,000 million spores liberated in twenty-four hours from a fruiting body with a pore surface of about one square foot. Discharge is not affected by variations in light, humidity of the air, or temperature within very wide limits; frost causes an instant cessation and thereafter there is no further spore fall until a new set of pores is organized.

"*Fomes applanatus* has been proved to be a wound parasite, and in southern Ontario at least one of the commonest and most destructive of this type. The proof rests on three grounds: (*a*) the conventional test applied to other such fungi—the mycelium works upward most readily by the way of the heartwood, causing a characteristic decay and outward into the sapwood, eventually reaching the cambium, and is apparently the cause of the death of the tissues traversed by it; (*b*) a broad brown band is present in the wood of living trees along the advance line of the invading mycelium of this fungus. Within this band there is a copious production of brown wound gum and an excessive multiplication of tyloses. This band steadily moves forward with the advanceing hyphae, the tyloses and wound gum being destroyed by the mycelium along its posterior margin as rapidly as they are formed along its anterior edge. The tyloses (and possible the wound gum also) certify to the living condition of the invaded tissues;

their production can be ascribed only to the influence of the fungus, and the invasion of these tissues and their fate demonstrates directly its ability to act as a parasite; (*c*) inoculations with the spores and mycelium of *F. applanatus* into living trees resulted in an extensive browning of the inoculated wood with a multiplication of tyloses—both far in excess of similar phenomena due to traumatic stimulation."

OUDEMANS' WORK ON FUNGI

The first volume of Oudemans' "Enumeratio Systematica Fungorum," with about 1,360 pages of text, appeared in the latter part of 1919. It contains a bibliography of 2,107 titles and a host index of all the cryptogams and the monocotyledons (as far as the orchids) that occur in Europe, either wild or in cultivation, with the fungi that are parasitic upon them. Engler's nomenclature has been followed in the main for the higher plants and Saccardo's for the fungi.

Oudemans died in 1906, having labored twenty-five years or more on this work. Dr. Lotsy succeeded in getting a Society at Haarlem to publish the manuscript, after it was revised and completed up to the year 1910 by de Boer, Paerels, and Vuyck. The first volume may be obtained for fifteen dollars from Martinus Nijhoff, Lange Voorhout 9, The Hague, Holland. The remaining four volumes are expected to appear in a few years.

This first volume is valuable because of its extended bibliography and the numerous citations to the literature of the fungi which it contains. As a host index for the fungi, it includes all European plants, many of which occur in this country, and also all plants grown in conservatories in Europe, among which will be found many species from tropical America.

W. A. MURRILL

ERRORS IN LINDAU'S "THESAURUS" AND SACCARDO'S "SYLLOGE"

Several years ago I sent in some corrections for Lindau and Sydow's Thesaurus litteraturae mycologicae . . .; a few more have come to my attention which I think may possibly be of interest to the readers of MYCOLOGIA.

In Lindau and Sydow's Thesaurus litteraturae mycologicae . . . under J. A. Mougeot (no. 77) occurs the title: Champignons des Vosges (Statist. du Départ. des Vosges, Epinal 1845, 127 p.); the same title is also given under A. Mougeot, by Traverso in his Supplementum alterum to Saccardo's Bibliotheca mycologicae . . . in the Sylloge fungorum, v. 17, p. lxxii. I have not been able to locate this work but I feel reasonably sure that it is wrongly credited to J. A. Mougeot. There seems to have been considerable confusion of the father (Jean Baptiste) and the son (Joseph Antoine or Antoine, as he is more often) given) by bibliographers. A notable example is that of the Royal Society's Catalogue of scientific papers, 1st series, which, however, corrected the mistake in the supplementary volume. There is no mention of any such work by J. A. Mougeot by his biographers; in fact it would not seem that his published mycological work dates so far back. It is most probably a reprint from J. B. Mougeot's Considérations générales sur la végétation spontanée du département des Vosges. This was first published in the Ann. Soc. Emul. Dép. Vosges in 1834 (Lindau no. 73), but according to Kirschleger in his Flore d'Alsace, v. 2, p. lxx–lxxi, included only the phanerogams; in 1845 it was reprinted with the addition of the cryptogams, in Lepage and Charton's Statistique du Département des Vosges (Lindau, no. 73a, the date 1835 must be a typographical error). An examination of a copy of the reprint of the Considérations générales . . . of 1845, discovers no indication that the son (J. A. Mougeot) had any hand in the work. The part dealing with fungi, both general text and the table of species, would cover about 127 p., which is given as the number of pages for the reprint "Champignons des Vosges."

Nos. 78 and 79, credited by Lindau to J. A. Mougeot, should also be transferred to J. B. Mougeot, the father.

I should be glad to get track of a copy of the "Champignons des Vosges," 1845, and would appreciate information in regard to its location.

It is very possible that the following note of correction for Saccardo's "Sylloge fungorum" has already been brought to the

attention of mycologists; on the chance that it may have escaped notice I am appending it.

Saccardo in his "Sylloge fungorum," v. 2, p. 352, cites as synonyms of *Ophiobolus herpotrichus*

Rhaph. herpotriche (Fr.) Fuck. Symb. Myc. p. 125.

Rhaph. lacroixii Mont. Syll. Crypt. n. 895.

In the "Synonymia" (v. 15 of the "Sylloge," p. 320) the species are given as *Rhaphidophora herpotricha* and *R. lacroixii.* In both cases the name used by Fuckel and Montagne is *Rhaphidospora* and not *Rhaphidophora.* This error should also be corrected in the Index to the "Sylloge" (v. 12, p. 663): *Rhaphidophora* Fr. et Mont. should read *Rhaphidospora* Fr. et Mont.

It might also be well to call attention to the fact that the abbreviation "Car. et de Not." which occurs in a number of places, especially under *Ophiobolus* in v. 2 and in v. 15, p. 320, under *Rhaphidophora,* should read "Ces. et de Not."

ALICE C. ATWOOD

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OBSERVATIONS ON THE GENUS ACROSPERMUM[1]

Lincoln W. Riddle

(With Plate 11, Containing 13 Figures)

Acrospermum is the name given to a small group of closely related fungi growing on living or dead herbaceous plants or plant-parts. The genus was established in 1790 by Tode in his Fungi Mecklenburgenses (part 1, page 8), with *Acrospermum compressum* as the type-species. The plants all have erect fructifications, more or less clavate or spatulate in form. The asci are elongated; contain eight filiform, colorless spores; and are surrounded by capillary paraphyses. The texture is horny when dry, fleshy-cartilaginous when moist. There are two peculiarities which have made the systematic position of the genus uncertain: the fructification is ordinarily compressed (compare Figs. 1 and 2), and the ostiole is elliptical rather than circular (Fig. 5). Ellis and Everhart (North American Pyrenomycetes p. 67, 1892) placed *Acrospermum* in the Hypocreales, to which it is obviously allied in texture and in the coloration of most of the species. Rehm, however, transferred the genus to the Hysteriales, because of the two peculiarities mentioned above, and this disposition has been accepted by Lindau, in Engler and Prantl, where he established a family, Acrospermaceae, in the Hysteriales.

Such an arrangement seems scarcely to express natural relationships since all of the Hysteriales are characteristically car-

[1] Contribution from the Cryptogamic Laboratories of Harvard University, No. 88.

[Mycologia for May (12: 115–174) was issued June 5, 1920.]

bonaceous and open by a cleft rather than by an elliptical ostiole. In order to determine whether the internal structure might throw light on the true systematic position of the genus, microtome sections of *Acrospermum compressum* and of a new species have been studied and have yielded certain results of interest. Reference to figure 11 will show that the lower part of the fructification is occupied by sterile tissue. This is more or less prosenchymatous in nature, differing from the substance of the wall and reminding one of the hypothecium or trama of a normal apothecium. Nevertheles, this does not necessarily indicate discomycetous affinities, for a similar structure is found in the perithecium of some Pyrenomycetes, for example *Bombardia fasciculata* Fr. Figure 12 illustrates the apical portion of the fructification somewhat more enlarged. It will be noticed that the paraphyses do not form a definite hymenium such as would be found in the Hysteriales, but that they converge loosely toward the ostiole rather in the manner of various Pyrenomycetes. Taking this into account together with the texture, and with the facts that a compressed form and elongated ostiole are found in the Lophiostomaceae, and a sterile basal tissue in *Bombardia* and other genera, it would seem to the writer that the natural conclusion is to consider the fructification a perithecium and to follow Ellis in placing the Acrospermaceae not under the Hysteriales but under the Hypocreales.[2]

Material distributed in the principal exsiccati under the specific name *Acrospermum compressum* Tode shows considerable variation (compare Figs. 7–10). The size varies from 0.8 to 2.5 millimeters. The form varies from spatulate, with the apex almost truncate (Fig. 8) to clavate with an obtuse apex (Fig. 10). The figures cited show a corresponding variation in the development of the stipe: in such perithecia as are figured in Nos. 7 and 8 there is merely a slight contraction below, scarcely to be referred

[2] Owing to delay in the receipt of German journals, because of the war, the present paper was in print before the writer saw a note by Von Hoehnel in the *Annales Mycologici* (15: 379. 1917), in which he expresses the view that *Acrospermum* is undoubtedly one of the Pyrenomycetes. Von Hoehnel believes that the characters in common with *Bombardia* indicate true relationship, and after naming two probable connecting links, he places *Acrospermum* in the Sordariaceae.

to as a stipe; while in the specimens distributed in Libert Plantae Cryptogamicae Arduennae No. 32 and in the Kryptogamae Exsiccatae Vindobonenses No. 1435, there is a well-defined stipe, cylindrical and of considerable relative length (Fig. 10). The surface varies from even (Fig. 7) to wrinkled (Fig. 8), and longitudinally furrowed (Fig. 10). The color is typically bay-brown,[3] but varies to seal-brown, snuff-brown, and russet; rarely (*e.g.*, Berkeley's British Fungi Exsiccati No. 270) it may be dull fuscous-black. The color of any given perithecium is usually fairly uniform throughout, but occasional specimens are seen (*e.g.*, Mougeot and Nestler Stirpes Cryptogamae Vogeso-Rhenanae No. 671), where the color becomes gradually paler toward the apex.

Connecting with the typical form of the species and distinguishable only as varieties are two plants which have been described as distinct species. The first of these is *Acrospermum graminum* Libert, usually smaller than *A. compressum,* somewhat darker in color, with a linear outline, and growing on dead leaves of grasses (Fig. 5). Rehm has already reduced this to varietal rank.

The second plant is *Acrospermum foliicolum* Berk. Authentic specimens in the Curtis Herbarium show that in size and in shape, Figs. 9 and 10 would represent this plant as well as the typical form of *A. compressum.* The color of *A. foliicolum* is in general lighter than that of *A. compressum,* being from honey-yellow to russet. But it will be noticed that darker specimens of the former coincide in color with lighter specimens of the latter. The only constant difference that the writer has been able to discover between the two forms is the habitat: all specimens of *A. compressum* that have been seen grow on stems, while all the specimens of *A. foliicolum* grow on Dicotyledonous leaves. This would scarcely seem to be of sufficient importance to maintain a specific difference between the two.

The variations of *Acrospermum compressum* may be summarized as follows:

ACROSPERMUM COMPRESSUM Tode. Fungi Mecklenb. 1: 8, *t. 2, f. 13.* 1790.

[3] All color terms in this paper are taken from Ridgeway: Color Standards and Nomenclature. 1912.

a. forma typica. On herbaceous stems; 1–2.5 mm. in height, more or less contracted below, bay-brown. Widely distributed in the United States.

b. var. GRAMINUM (Lib.) Rehm in Rabenh. Krypt. Fl. Deutschl. 1^3: 55. 1887.

Acrospermum graminum Libert Pl. Crypt. Ard. fasc. 1, No. 33. 1830, cum descript.

On dead leaves of grasses; 0.4–1.0 mm. in height, linear in outline, chocolate to warm brownish-black. Recorded in the United States from New York, Missouri, and California.

c. var. **foliicolum** (Berk.) Riddle comb. nov.

Acrospermum foliicolum Berk. Grevillea 4: 161. 1876.

On dead leaves of *Celtis, Cornus, Ulmus*, etc.; 0.7–1.5 mm. in height, stipitate, honey-yellow to russet. Apparently confined to the warmer portion of the United States: specimens examined from New Jersey, North and South Carolina, Louisiana, Texas; and recorded from Alabama.

In 1914, Mr. W. R. Maxon, of the United States National Herbarium, sent to Dr. W. G. Farlow specimens of an *Acrospermum* growing on the living fronds of a tropical fern. In the accompanying letter (Oct. 14, 1914), Mr. Maxon says: "I am sending you herewith two specimens of *Polypodium induens* Maxon, these being my 2770 from Jamaica and my 5486 from Panama, both of which seem to be affected with a fungus. I have never seen anything like it, and it seems to me a curious coincidence that what appears to be the same organism should occur upon individuals of the same species from widely separated regions." In a subsequent letter (Dec. 11, 1914), Mr. Maxon adds: "I have gone over all of the material of *P. induens* and find the fungus occurring upon nearly every collection of it." Dr. Farlow recognized that the material represented a new species and named it in honor of Mr. Maxon, labeling the specimens in the herbarium accordingly. No description was published, however, and after Dr. Farlow's death, Mr. Maxon called the present writer's attention to the plant, and suggested the publication of some account of it.

This new species may be described as follows:

Acrospermum Maxoni Farlow in herb. sp. nov.

(Plate II, Figures 1–5)

Perithecia solitaria dispersa aut rarius geminata, superficialia erecta, 0.7–1.3 mm. altit., 0.22–0.3 mm. latit., clavata compressa; apice rotundato vel obtuso; infra in stipitem tenuem cylindricem attenuata, stipite 0.2–0.27 mm. altit., 0.07–0.09 mm. diam.; primitus clausa dein ostiolo ellipsoideo aperta; siccis coriaceis, madefactis carneo-cartilagineis; fusco-nigra nitida, apice argillaceo; basi mycelio distincto irregulare rotundato arachnoideo circumcincto, centro fusco, margine stramineo. Asci 8-spori anguste cylindrices elongatae, circa 400 μ longi, 5 μ lati; sporidiis hyalinis filiformibus irregulariter flexuosis haud spirale contortis. continuis, parum brevioribus quam ascis, circa 1 μ latis. Paraphyses copiosae capillariae.

On the under side of living fronds of *Polypodium induens* Maxon, in humid forest, Chiriqui, Panama, March 18, 1911, collected by W. R. Maxon, no. 5486*a* (type); same locality, no. 5714*a;* vicinity of Coliblanco, Costa Rica, May 1, 1906, no. 278*a;* vicinity of Morce's Gap, Jamaica, June 23, 1904, no. 2770*a;* Apr. 18, 1903, no. 1214 *a;* Sir John's Peak, Jamaica, no. 1324 *a,* all collected by W. R. Maxon. Forests of Santa Rosa du Copey, Costa Rica, April, 1898, collected by Tonduz, without number.

On *Polypodium cretatum* Maxon, Monkey Hill, above New Haven Gap, Jamaica, June 22, 1904, collected by W. R. Maxon, nos. 2702*a,* 2754*a;* Sir John's Peak, Jamaica, Sept. 1906, collected by L. M. Underwood, no. 3203*a.*

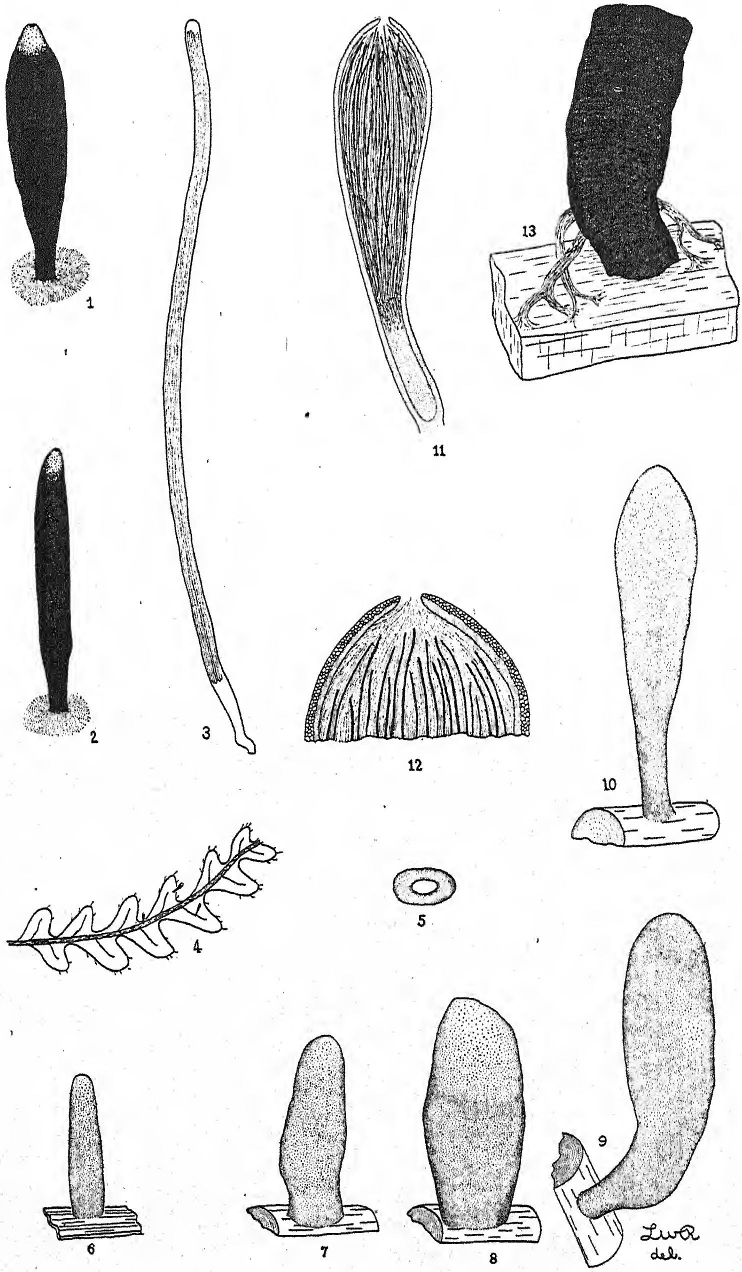
Acrospermum Maxoni differs from *A. compressum* in the contrast between the *shining* black perithecia and the clay-colored tips; in the peculiar mycelial web, surrounding the base of the perithecium; and in the habit of growing on living ferns. These characters distinguish it also from *A. Puiggarii* Spegazzini (Bol. Acad. Nac. de Ciencias de Cordoba **23**: 121. 1919) described as growing over mosses in Brazil and as having black perithecia, becoming pallid toward the base. *Microstelium hyalinum* Patouillard (Bull. Soc. Myc. France **15**: 208. *pl. 9, f. 1.* 1899), encrusting algae and mosses on tree-trunks in Guadeloupe, is said by

its author to be related to *Acrospermum;* and Lindau in the "Nachtraege" to Engler and Prantl's Naturlichen Pflanzenfamilien I[1]. 1900, places it in the Acrospermaceae. According to Patouillard's original description, his plant has a superficial mycelium somewhat similar to the mycelial web of *Acrospermum Maxoni,* but also has the perithecium covered with a filamentous "trama."

In 1881, Ellis (Bull. Torrey Bot. Club 8: 124) described a fungus from Utah under the name *Acrospermum corrugatum.* In 1884 the same fungus was found in California by Harkness and named by him *Acrospermum fultum* (Bull. Calif. Acad. 1: 47). An examination of material issued in Ellis and Everhart's North American Fungi Series II, no. 2055, shows that this species has marked peculiarities which distinguish it clearly from all Acrosperma, as the following comparison will indicate:

Typical *Acrospermum*	"*Acrospermum corrugatum*"
Texture fleshy-cartilaginous.	Texture carbonaceous.
Corrugations occasionally present in dried specimens, but disappearing upon moistening.	Corrugations strongly marked and persistent even when moist.
Ostiole merely elliptical.	Ostiole an elongated, narrow cleft.
Growing on herbaceous plants or plant-parts.	Growing on dead wood.

Since "*Acrospermum corrugatum*" does not possess the typical and characteristic features of a true *Acrospermum,* it became evident that it should be excluded from the genus. Further study led to the discovery that Ellis' plant is identical with the long-known but comparatively rare European species: *Lophium dolabriforme* Wallr. (Flora Crypt. Germ. 2: 433. 1833) not hitherto recognized from the American continent. In addition to the characters already noted, all of the descriptions of *Lophium dolabriforme* emphasize the peculiar rope-like, mycelial strands around the base of the apothecium (see Fig. 13) and these are well shown in the specimens issued in Vestergren Micromycetes Rariores Selecti no. 921. In addition to the Utah and California stations, Rostrup (Medd. on Groenl. 18: 61. 1894) has recorded



ACROSPERMUM

this plant from Greenland. And in 1905, Dr. Roland Thaxter collected it at Punta Arenas, Chile, in the Straits of Magellan.

HARVARD UNIVERSITY,
CAMBRIDGE, MASSACHUSETTS.

EXPLANATION OF PLATE 11

All of the figures, with the exception of nos. 3, 4, 5, and 12, were drawn to the same scale with a Spencer Lens Company 5-x eye-piece and 16 mm. objective; and have been reduced about one third in reproduction.

Figs. 1–5. *Acrospermum Maxoni* Farlow.

1. Perithecium, face view, with mycelial web at base.
2. Perithecium, side view.
3. Single ascus, with spores.
4. Habit, enlarged about 2 ×.
5. Apex of perithecium cut off and viewed from above to show the elliptical ostiole.

Fig. 6. *Acrospermum compressum* var. *graminum* (Libert) Rehm, from Rabenhorst Fungi Europaei Exsiccati no. 776.

Figs. 7–12. *Acrospermum compressum* Tode.

7. Ex herb. Fuckel in herb. Farlow.
8. Ellis North American Fungi no. 1318.
9. Klotzsch Herbarium Vivum Mycologicum no. 738.
10. Libert Plantae Cryptogamicae Arduennae no. 32.
11. Longitudinal section of entire perithecium from Kryptogamae Exsiccatae Vindobonenses no. 1435. Diagrammatic.
12. Apical portion of some, more enlarged. Semi-diagrammatic.

Fig. 13. *Lophium dolabriforme* Wallr. from specimen collected by R. Thaxter in Chile.

NEW SPECIES AND RELATIONSHIPS IN THE GENUS COLEOSPORIUM

George G. Hedgcock, N. Rex Hunt, and Glenn G. Hahn

A study of the species of the form genus *Peridermium* occurring on the needles of pines in the United States, and of their relation to the various species of *Coleosporium* in the same range was begun by the senior writer in 1912. He has since been assisted in this work as follows: by William H. Long in 1914, by N. Rex Hunt from 1915 to 1918, and by Glenn G. Hahn in 1919 and 1920. All collections cited in this paper without the name of the collector were made by the senior writer; where made by others the name of the collector is given. This paper gives some of the results of the more critical sets of inoculations made with several species, chiefly during the past three years.

In the descriptions of fungi given in this paper, all measurements for averages are based upon either 50 or 100 individual measurements. Materials for study are prepared as follows: dried specimens are first placed in water, then heated to the boiling point, transferred to a 10 per cent. gum arabic solution for 15 minutes and sectioned with a freezing microtome. Sections are mounted in a solution of 30 per cent. glycerine in water tinged with erythrosin. Measurements of the sori of pycnia and aecia in length and width are taken chiefly from unsectioned dry material. Measurements of cell walls are the estimated median for the side walls of each cell and include wall papillae. The colors of pycnia, aeciospores, and peridia are based on fresh material.[1] As has already been pointed out (7),[2] the color in fresh pycnia furnishes a good diagnostic character. Pycnia when old fade, and although this feature loses in value with age, other characters still hold, such as arrangement on the leaves, and size.

[1] Colors used are those of R. Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912.

[2] Numbers in parentheses refer to publications cited at the close of the paper.

All type specimens for the species described in this paper are deposited in the Pathological Collections of the United States Department of Agriculture, Washington, D. C. The numbers given with collections apply to collections for study in the Office of Investigations in Forest Pathology, Washington, D. C.

COLEOSPORIUM APOCYNACEUM

On March 27, 1918, near Silver Springs, Florida, a beautiful *Peridermium* with delicate fimbriate peridia was collected from the needles of *Pinus caribaea*,[3] *P. palustris*, and *P. taeda*, in direct association with plants of *Amsonia ciliata*[4] bearing the uredinia of *Coleosporium apocyraceum* Cooke, which were evidently from a recent infection. Inoculations were made April 3, 1918, by Hunt on six plants of *Amsonia ciliata* at Washington, D. C., in a greenhouse, with the aeciospores of the *Peridermium* from *Pinus taeda*. On April 15, the uredinia of *Coleosporium apocynaceum* Cooke appeared on the leaves of one plant, and later the telia, establishing that this *Peridermium* is the aecial stage of *Coleosporium apocynaceum* (10). Hedgcock repeated this inoculation on plants of *Amsonia ciliata* May 27, 1918, with aeciospores from a collection of the *Peridermium* from *Pinus palustris* at Silver Springs, May 7, 1918. Uredinia appeared on two plants June 9, and a month later telia were formed. Control plants in both these experiments remained free from the rust. Inoculations made with urediniospores on plants of *Amsonia ciliata* April 24 and May 24, 1918, resulted in the production of uredinia May 8 and June 9, respectively and of telia about a month later.

The aecial stage of *Coleosporium apocynaceum*, for convenience in distinguishing it from other species of the form genus *Peridermium*, is here named **Peridermium apocynaceum** (Cooke) Hedgc. & Hunt, comb. nov., with the following description:

Pycnia, amphigenous, scattered, in one row on each side of the leaf, conspicuous, on chlorotic spots, dehiscent by a longitudinal slit, hazel-brown to chestnut-brown, 0.4–0.8 mm. wide, 0.6–1.4

[3] The name of forest trees used in this paper are those recognized by Geo. B. Sudworth in various publications of the Forest Service, Washington, D. C.

[4] The names of herbaceous plants and of shrubs are those recognized by J. K. Small, Flora Southeastern United States, 1913.

mm. long, and 0.1–0.2 mm. high, averaging 0.5 by 0.85 by 0.16 mm.; pycnospores 2–3 by 4–7 μ, averaging 2.4 by 5 μ.

Aecia from a limited mycelium, amphigenous, one to several in a single row usually on the inner sides of the leaves, on chlorotic spots, occasionally confluent, flattened laterally, rectangular before rupturing, 0.26–0.5 mm. wide, 2–20 mm. long, and 0.25–0.45 mm. high, after rupture, averaging 0.35 by 6.1 by 0.35 mm.; peridium thin, rupturing circumscissally, the ruptured edges recurved and lacerated or irregularly fringed, fragile; peridial cells ellipsoid to cylindric, occasionally clavariform, 18–33 μ wide, 25–63 μ long, averaging 23 by 42 μ, slightly overlapping but loosely adherent, with walls 2–6 μ thick, averaging 4.4 μ, outer walls thicker than inner, both verrucose with cylindric papillae 1–2 μ in diameter by 2–6 μ in length, averaging 1.3 by 3.8 μ; aeciospores ovoid to ellipsoid, occasionaly pyriform, 16–23 by 22–42 μ, averaging 19.1 by 31.5 μ, contents orange, fading when old, walls 3–6 μ thick, averaging 4.7 μ, verrucose with short, blunt tubercles 2–4 μ in diameter and 2–6 μ long, averaging 2.6 by 3.9 μ.

Coleosporium apocynaceum Cooke has been collected in the United States only as follows:

O. and I. On *Pinus* near Ocala, Florida:

P. caribaea, in 1918, March 27 (25212) and April 7 (29101).

P. palustris, in 1918, March 27 (25214, type collection), April 7 (29100); in 1919, February 27 (32141) and May 15 (32379).

P. taeda, in 1919, March 27 (25213) and May 15 (32384).

II and III. On *Amsonia:*

A. amsoniae, South Carolina, in 1860, by H. W. Ravenel, Pinopolis (Fungi Caroliniani Exsiccati, 489); Alabama, in 1864, by T. M. Peters (Peters Collection, University of Alabama); in 1896, by F. S. Earle and L. M. Underwood, Auburn, Alabama, July (Flora Alabama).

A. ciliata, South Carolina, in 1852, by H. W. Ravenel, Aiken (Fungi Caroliniani Exsiccati 44); in 1916, by G. G. Hedgcock, Clearwater, September 27 (24102); Florida, in 1918, Silver Springs, Ocala, March 27 (25215), May 7 (25299), May 24 (25284 & 29116); and in 1919, May 15 (32378).

COLEOSPORIUM LACINIARIAE

Arthur first described the uredinia and telia of *Coleosporium laciniariae* in 1907 (1), reporting it from specimens of *Laciniaria*

graminifolia from Auburn, Alabama. He also mentioned its occurrence on *L. chapmani* in Florida. Since 1907, the known range of this species of *Coleosporium* has been greatly extended and a number of additional hosts found (6).

Peridermium fragile Hedgc. and Hunt (7) was first recognized in Florida at Brooksville on the needles of *Pinus palustris,* March 11, 1915. Numerous inoculations were made by Hedgcock and Hunt during 1915, 1916 and 1917 with the aeciospores of this *Peridermium* on many plants of species of *Aster, Chrysopsis, Elephantopus, Euthamia, Laciniaria, Pharbitis, Solidago, Verbesina* and *Vernonia,* without results. The plants of *Laciniaria* used were in poor condition. In the autumn of 1916, the collection of *Coleosporium laciniariae* on plants in direct association with pine trees which earlier in the season were infected with *Peridermium fragile,* indicated that *Laciniaria* was the alternate host genus for this species of *Peridermium.* Good thrifty plants of *Laciniaria* were secured and kept in stock. On March 20, 1918, Hunt inoculated the leaves of several species of *Laciniaria* with the aeciospores of this *Peridermium* from *Pinus palustris* (25135) at Ocala, Fla., March 15, 1918. One plant of *Laciniaria graminifolia* was infected, uredinia appearing April 11, and telia later. On March 4, 1919, Hedgcock inoculated one plant of *Laciniaria* sp. with aeciospores collected from *Pinus palustris* at Ocala, Fla., February 27. On March 22, uredinia appeared on the leaves. Telia were noted June 5. In both experiments control plants remained free from the rust. This proves that *Peridermium fragile* Hedgc. and Hunt is the aecial stage of *Coleosporium laciniariae* Arthur.

Coleosporium laciniariae Arthur has been collected as follows, the data being taken from collections in this office.

O and I. On *Pinus:*

P. palustris, Florida, in 1915, Brooksville, March 11 (17426, type of *Peridermium fragile*), March 11 (17427), March 12 (17430); in 1916, March 17 (20780, 20781, 20786 and 20787); in 1918, March 17 (25163); in 1919, March 2 (32161 and 32162), March 3 (32172); May 15 (32465); Ocala, in 1916, March 16 (20775); in 1918, March 15 (25135); in 1919, February 28

(32153); in 1919, Gainesville, March 20 (20806); in 1919, Lake City, March 12 (32231); Georgia, in 1915, Waycross, April 1 (17594).

P. rigida, New Jersey, in 1916, Pleasantville, June 5 (22347); Mount Calvary, June 5 (22348); in 1917, Mount Calvary May 12 (26522); District of Columbia in 1917, Washington, May 31 (24522).

II and III. On *Lacinaria:*

L. elegans, Florida, in 1915, Ocala, October 27 (20073); Jacksonville, October 30 (20085).

L. elegantula, Alabama, in 1915, Auburn, October 7 (18895).

L. gracilis, Florida, in 1915, Lake City, October 25 (20057); Brooksville, October 28 (20077).

L. graminifolia, New Jersey, in 1915, Pleasantville, September 12 (17952); in 1916, Mount Calvary, September 2 (22762, 22763, 22764, 22765, 22766, 22767 and 22768); in 1917, September 18 (22620).

L. laxa, Florida, in 1915, Tampa, October 29 (20082).

L. squarrulosa, Arkansas, in 1915, Bald Knob, October 12 (18890); Tennessee, in 1916, Big Frog Mountain, September 21 (22864); Georgia, in 1916, Atlanta, September 24 (22958).

L. tenuifolia, Florida, in 1915, Lake City, October 25 (20058); Tampa, October 29 (20081); Jacksonville, October 30 (20086).

From these data, it will be seen that our known range of *Coleosporium laciniariae* is from New Jersey to Florida and Arkansas.

PERIDERMIUM MINUTUM

Peridermium minutum Hedgc. and Hunt (7) is a small species of leaf *Peridermium* known only from Florida. It was first collected at Brooksville in 1915, and again in 1916 in the same locality and also at Gainesville. Repeated attempts without result were made in 1916 to infect plants withthe aeciospores of this rust, using species of *Aster, Campanula, Calonyction, Coreopsis, Chrysopsis, Elephantopus, Helianthus, Ipomoea, Laciniaria, Parthenium, Pharbitis, Quamoclit, Silphium, Solidago, Verbesina* and *Vernonia*. On May 6, 1918, near Gainesville, Fla., the uredinia of a *Coleosporium* were found occurring abundantly on the leaves

of *Adelia ligustrina* under a tree of *Pinus glabra* heavily infected with *Peridermium minutum*. Healthy plants of *Adelia ligustrina* secured from another locality were packed in direct contact with fresh aecia of this *Peridermium*, mailed to Washington, D. C., and placed in pots. The uredinia of the *Coleosporium* appeared on these plants in about two weeks after they were potted, and later telia. On March 28, 1919, inoculations were made again in the greenhouse at Washington, D. C., on eight healthy plants of *Adelia ligustrina* with the aeciospores of the Peridermium collected on *Pinus glabra* at Gainesville, Fla., February 28, 1919. Uredinia of the Coleosporium appeared on the leaves of three plants April 14, and telia about June 1; six control plants remained free from the rust. This proves that it is the alternate stage of *Peridermium minutum* (10). This species of *Coleosporium* with minute sori differs from other known species of this genus, and is now given the name **Coleosporium minutum** Hedgc. and Hunt, comb. nov., with the following description:

Uredinia hypophyllous, numerous, small, scattered on slightly chlorotic areas on the leaves, circular to elliptic, 0.1–0.5 mm. in diameter, averaging 0.25 mm., orange-chrome, fading with age to white, ruptured epidermis inconspicuous; urediniospores sphaeroid to obovoid or ellipsoid, 15–23 by 18–31 μ, averaging 18.7 by 24.5 μ, walls irregularly thickened at the apex, 2–8 μ thick. averaging 4.9 μ verrucose with coarse conical tubercles, 2–4 μ in diameter, averaging 2.6–3.8 μ.

Telia hypophyllous, small, scattered or somewhat gregarious, rarely confluent, circular to elliptic in outline, 0.16–0.36 by 0.18–0.36 mm., averaging 0.22 by 0.26 mm., grenadine red, darkening with age; teliospores with wall swelling 20–36 μ above, averaging 24.2 μ; contents orange-chrome, fading to almost colorless, cylindric to clavate or oblong, 18–32 by 30–70 μ, averaging 23.1 by 44.9 μ, rounded or obtuse at the apex, obtuse to narrowed below.

Coleosporium minutum Hedgc. and Hunt has been collected in the United States only and as follows:

O and I. On *Pinus:*

P. glabra, Florida, in 1916, Gainesville, March 14 (20737), March 15 (20768, type of *Peridermium minutum*), March 20 (20801); in 1918, March 13 (25126), March 28 (25223), May 6 (29118); in 1919, February 24 (32103) and March 12 (32230).

P. taeda, Florida, in 1915, Brookville, March 12 (17439); in 1916, March 17 (20782); in 1919, March 2 (32165), March 11 (32229).

II and III. On *Adelia:*

A. ligustrina, Florida, in 1918, Gainesville, May 6 (25298, type of *Coleosporium minutum*); in 1919, May 14 (32363, 32862); Brooksville (32395); District of Columbia, in 1918, Washington, June 20 (29194).

COLEOSPORIUM ELEPHANTOPODIS

The successful inoculation of *Elephantopus* with *Peridermium carneum* Am. Auct. was first reported in 1917 (8), indicating the possible identity of *Coleosporium elephantopodis* (Schw.) Thüm. with *Coleosporium carneum* (Bosc) Jackson (*C. vernoniae* B. & C.). A careful study of these two species, however, has established the fact that they are not identical (10). The two are distinct in their host adaptation, in addition to slight differences in morphology. Even if these two species are not considered separate and distinct, they must at least be considered races of the same species. The writers choose to treat them as separate species, for reasons which follow:

Of 22 sets of inoculations made with *Peridermium carneum* in 1914, 8 infected plants of species of both *Elephantopus* and *Vernonia*, and 14 infected only those of *Vernonia*. Of 44 sets of inoculations made in 1915, 3 infected plants of species of both genera, 4 only those of *Elephantopus* and 37 only those of *Vernonia*. Of 28 sets of inoculations in 1916, 8 infected plants of species of both genera, 8 only those of *Elephantopus*, and 12 only those of *Vernonia*. In 1916 an effort, partially successful, was made to separate collections of *Peridermium carneum* by macroscopic characters into two lots, the one belonging to *Coleosporium elephantopodis*, the other to *Coleosporium carneum*. Later efforts have been quite successful.

From 1916 to 1919, 31 sets of inoculations have been made from aecial material adjudged to be the aecia of *Coleosporium carneum;* of these 24 infected only plants of species of *Vernonia*, 7 infected those of both *Vernonia* and *Elephantopus*, and none of

them, *Elephantopus* only. During the same period, 23 sets of inoculations have been made from aecial material adjudged to be the aecia of *Coleosporium elephantopodis;* of these, 17 infected only plants of species of *Elephantopus,* 6 infected plants of species of both *Elephantopus* and *Vernonia,* while in no case were those of *Vernonia* alone infected.

From 1916 to 1919, 10 sets of inoculations were made with aecial material grown in the greenhouse at Washington, D. C., by inoculating pines in incubation chambers with sporidia from the fresh telia of *Coleosporium elephantopodis.* In all of these sets, plants of species of *Elephantopus* were infected, those of *Vernonia* in each set remaining free from infection. During the same period, aecial material of *Coleosporium carneum* grown in the same manner was used in 4 sets of experiments with the result that only plants of species of *Vernonia* were infected, those of *Elephantopus* in each set remaining free from infection.

From 1914 to 1919, 7 sets of inoculations were made with the urediniospores of *Coleosporium elephantopodis* resulting in the infection only of plants of species of *Elephantopus,* those of *Vernonia* in each set remaining free from infection. During the same period 8 sets of inoculations were made with the urediniospores of *Coleosporium carneum,* resulting in the infection only of plants of species of *Vernonia,* those of *Elephantopus* in each set remaining free from infection. From the foregoing results we conclude that these two Coleosporiums are distinct species physiologically.

The *Peridermium* which infects plants of species of *Elephantopus* is very much less common than the one infecting plants of species of *Vernonia.* The former fungus has fewer, smaller, and lighter colored pycnia, which are ordinarily in shorter rows than those of the latter. The aecia of the former are more commonly somewhat triangular in side view, and usually slightly smaller. The peridial cells of the former usually do not overlap, while those of the latter are commonly overlapping. The aeciospores and urediniospores of the former are slightly smaller and more commonly globose and their cell walls are usually nearly uniform in thickness, while those of the latter are frequently distinctly thickened at the apex.

Upon the basis of the above physiological and morphological differences, the aecial form of *Coleosporium elephantopodis* (Schw.) Thüm. is designated **Peridermium elephantopodis** (Schw.) Hedgc. and Hahn, comb. nov. to distinguish it from other species of the form genus *Peridermium*, with the following description:

Pycnia amphigenous, solitary to several in one or two rows on chlorotic spots more commonly on the inner sides of the needles, dehiscent by a longitudinal slit, capucine-buff to orange-buff when immature, cadmium-orange to orange when sporulating, amber-brown to antique-brown at the time aecia are formed, 0.35–0.64 mm. wide, 0.36–1.06 mm. long, 0.08–0.2 mm. high, averaging 0.42 by 0.75 by 0.12 mm.; pycnospores, ovoid to ellipsoid 2–4 by 4–6 μ, averaging 2.3 by 4.1 μ.

Aecia amphigenous, solitary to few in one or two short rows, more commonly on the inner sides of the needles, flattened laterally, irregularly triangular to rectangular in side view, 0.3–0.9 mm. wide, 1.1–7.9 mm. long, 1.0–3.6 mm. high, averaging 0.7 by 3.5, by 2.3 mm.; peridia often vertically striated, orange-pink when fresh, rupturing longitudinally at the apex with irregularly notched edges; peridial cells in one layer, slightly or not overlapping, rectangular in cross section 20–40 by 32–72 μ, averaging 32 by 47 μ, with thick walls, 6–12 μ in diameter, averaging 8.5 μ, walls commonly verrucose, the inner with thickly set papillae 1–2 μ in diameter, 3–6 μ long, averaging 1.5 by 4.3 μ, aeciospores globoid to obovoid, or ellipsoid, capucine-orange in mass 14–24 by 20–32 μ, averaging 19 by 26 μ, with walls slightly or not at all thickened at the apex, 3–6 μ thick, averaging 4.2 μ, the outer surface closely verrucose with tubercles 1–2 μ in diameter, 2–4 μ long, averaging 1.4 by 2.6 μ.

The foregoing description is based on aecia from *Pinus caribaea* (20818) grown under controlled conditions in the greenhouse at Washington, D. C., from inoculations with sporidia from the telia of *Coleosporium elephantopodis* from *Elephantopus carolinianus*.

Coleosporium elephantopodis (Schw.) Thüm. has been found in the United States as follows, the data being taken from collections made by members of this office, chiefly by the senior writer.

O and I. On *Pinus:*

P. canariensis; District of Columbia.*[5]

P. caribaea; District of Columbia* and Florida.

P. contorta; District of Columbia.*

P. coulteri; District of Columbia.*

P. echinata; Alabama, District of Columbia* and Georgia.

P. mayriana; District of Columbia.*

P. palustris; Alabama, District of Columbia,* Florida, Mississippi, North Carolina and South Carolina.

P. radiata; District of Columbia.*

P. rigida; District of Columbia and North Carolina.

P. serotina; Florida.

P. taeda; Alabama, District of Columbia,* Florida, Georgia, Mississippi, North Carolina, South Carolina and Texas.

II and III. On *Elephantopus:*

E. carolinianus; Alabama, Arkansas, District of Columbia,* Florida, Georgia, Louisiana, Mississippi, North Carolina, South Carolina, Virginia, and Texas.

E. elatus; District of Columbia,* Georgia and Mississippi.

E. nudatus; Florida.

E. tomentosus; District of Columbia,* Florida, Mississippi, North Carolina, South Carolina and Tennessee.

COLEOSPORIUM CARNEUM

Peridermium carneum (Bosc) Seym. & Earle, the aecial form of *Coleosporium carneum* (Bosc) Jackson (9) was first described and illustrated by Bosc (5) in 1811 from a specimen on *Pinus palustris* from South Carolina. The description is meager and might apply to most any species of *Peridermium* on the needles of pine from South Carolina. The illustration, however, which Bosc gives is that of the form of *Peridermium carneum* found to infect species of *Vernonia* in our inoculations. Arthur in 1910 (2) first proved that *Peridermium carneum* belongs to *Coleosporium carneum* on species of *Vernonia.*

In order to set apart the aecial form of *Coleosporium carneum* from that of *Coleosporium elephantopodis,* the following descrip-

[5] Hosts or collections obtained from artificial inoculations in the greenhouse at Washington, D. C., are indicated here and later by an asterisk (*).

tion is given of *Peridermium carneum* made from aecia on *Pinus caribaea* (25282) grown under similar and controlled conditions in the greenhouse at Washington, D. C., from inoculations with sporidia from the telia of *Coleosporium vernoniae* from *Vernonia noveboracensis*.

Pycnia amphigenous, solitary to several, in a single extended row on each side of the needles chiefly the inner, on distinctly yellowed-chlorotic spots, salmon-orange to orange-chrome before and at maturity, orange-rufous to auburn or chestnut after maturity, 0.1–0.2 mm. wide, 0.6–1.4 mm. long, 0.4–1 mm. high, averaging 0.13 by 0.57 by 0.92 mm.

Aecia amphigenous, solitary to several, extended in a single row chiefly on the inner sides of the needles, flattened laterally, usually irregularly rectangular or truncate, occasionally irregularly triangular in side view, 0.4–0.9 mm. wide, 1.5–8.4 mm. long, 1.8–4 mm. high, averaging 0.7 by 3.3 by 2.6 mm.; peridia sometimes vertically striate, rupturing longitudinally at the apex with irregular edges; peridial cells irregularly rhomboidal in cross section, usually considerably overlapping, 20–38 by 33–45 μ, averaging 27 by 29 μ, with thick walls 4–8 μ in diameter, averaging 5.2 μ, the inner walls, sometimes the outer, verrucose with dense papillae 1–2 by 3–5 μ, averaging 1.7 by 3.8 μ; aeciospores, obovoid to ellipsoid, 16–25 by 25–38 μ, averaging 21.8–33.2 μ, with walls often thickened at the apex, walls 3–9 μ thick, averaging 6 μ, the outer surface verrucose with tubercles 2–3 by 2–7 μ, averaging 1.9 by 3.9 μ.

Coleosporium carneum (Bosc) Jackson has been found in the United States as follows, the data being taken from collections made by members of this office, chiefly by the senior writer:

O and I. On *Pinus:*

P. caribaea; District of Columbia,* Florida.

P. clausa; Florida.

P. coulteri; District of Columbia.*

P. echinata; Alabama, Arkansas, District of Columbia,* Florida, Georgia, North Carolina, South Carolina, Tennessee, Texas and Virginia.

P. glabra; Florida.

P. mayriana; District of Columbia.*

P. nigra autriaca; Ohio.

P. nigra laricio; Ohio.

P. palustris; Alabama, District of Columbia,* Florida, Georgia, Louisiana, North Carolina and South Carolina.

P. ponderosa (*P. scopulorum*); District of Columbia, Ohio.

P. rigida; Connecticut, District of Columbia, Maryland, North Carolina, Ohio, Pennsylvania, Virginia and West Virginia.

P. sabiniana; District of Columbia.*

P. serotina; District of Columbia,* Florida, Georgia and South Carolina.

P. taeda; Alabama, Arkansas, District of Columbia,* Florida, Georgia, Mississippi, New Jersey, North Carolina, South Carolina and Virginia.

II and III. On *Vernonia:*

V. angustifolia; Florida.

V. baldwinii; Arkansas, District of Columbia,* Mississippi and Texas.

V. blodgettii; District of Columbia,* Florida, North Carolina and South Carolina.

V. drummondi; Arkansas and Mississippi.

V. flaccidifolia; Alabama, District of Columbia,* Florida, Georgia and South Carolina.

V. gigantea; Georgia, Mississippi, South Carolina and Tennessee.

V. glauca; District of Columbia,* Louisiana and Maryland.

V. interior; Arkansas, District of Columbia* and Texas.

V. maxima; Alabama, Georgia, Louisiana, Ohio and Tennessee.

V. noveboracensis; Alabama, Connecticut, District of Columbia,* Georgia, Maryland, New Jersey, North Carolina, Pennsylvania, South Carolina, Tennessee, Virginia and West Virginia.

V. oligantha; District of Columbia,* Florida and Louisiana.

V. ovalifolia; Alabama.

V. texana; Louisiana and Texas.

V. tomentosa; Georgia and Louisiana.

Peridermium floridanum sp. nov.

A new leaf *Peridermium* was collected on *Pinus palustris* near Ocala, Florida, March 17, 1916, but with the aecia frayed and past mature. This rust was found again on the same trees,

March 15, 1918. Hunt made inoculations March 27, 1918, with the aeciospores from the latter collection on 2 plants of *Verbesina virginica* without result. Collections of the fungus in the same locality were made from different trees February 26 and 28, 1919, but no clues as to its alternate host were secured later in the year during the season for telia. This rust approaches *Peridermium acicolum* in its gross morphology but differs in the color and arrangement of the pycnia, and in the arrangement of the aecia on the leaves. It is here named **Peridermium floridanum** Hedgc. & Hahn, with the following description:

Pycnia amphigenous, several, usually in a single row on the inner surfaces of the needles, on chlorotic spots, subcuticular, dehiscent by a longitudinal slit, tawny to russet, 0.36–0.8 mm. wide, 0.5–1.5 mm. long, 1–3 mm. high, averaging 0.52 by 1.04 by 0.15 mm.

Aecia amphigenous, on chlorotic spots, usually in a single row on the inner surfaces of the needles, 0.48–0.68 mm. wide, 0.9–3.6 mm. long, 0.76–2.16 mm. high, averaging 0.58 by 1.8 by 1.42 mm.; peridia flattened laterally, rupturing longitudinally at the apex with irregularly notched edges, peridial cells usually not overlapping in one layer, occasionally two layers at the base; ovoid to ellipsoid or rhomboid, 17–32 by 32–78 μ, averaging 22 by 53 μ, with walls 4–8 μ, averaging 5.4 μ, the outer walls thicker, walls verrucose with crowded papillae 1–2 μ in diameter, 3–6 μ long, averaging 1 by 4.4 μ aeciospores obovoid to ellipsoid, 12–20 by 22–38 μ, averaging 17 by 29 μ, with walls 1–4 μ thick, averaging 3 μ, the outer surface verrucose with short tubercles, 1–3 μ in diameter by 1–4 μ long, averaging 1.5 by 2.6 μ.

This *Peridermium* has been collected only in Florida near Ocala on *Pinus palustris* as follows: in 1916, March 17 (specimens lost); in 1918, March 15 (25137); in 1919, February 26 (32129), February 28 (32150, type of species).

PERIDERMIUM INTERMEDIUM

From 1914 to 1919, collections of *Peridermium intermedium* Am. Auct. from the needles of *Pinus echinata* were made from Alabama, Arkansas, Georgia, North Carolina, South Carolina, Tennessee and Texas. These were used in 18 sets of experiments in which there were inoculated 192 plants of species of

Aster, Chrysopsis, Coreopsis, Elephantopus, Euthamia, Helianthus, Ipomoeae, Pharbitis, Solidago, Verbesina, and *Vernonia* known to be susceptible to species of *Coleosporium*. In 9 of these experiments, plants of species of *Vernonia* only were infected; in one experiment, plants of species of both *Vrnonia* and *Elephantopus;* and in 8 experiments there was no infection. Control plants in each experiment remained free from infection.

In our inoculations with sporidia from the telia of both *Coleosporium elephantopodis* and *Coleosporium carneum* trees of *Pinus echinata* were infected the following year, bearing aecia of the species used in inoculations, proving that this species of pine is a host for both species of *Coleosporium*.

Of 54 collection of *Peridermium intermedium* Am. Auct. on *Pinus echinata* collected by members of this office in Alabama, Arkansas, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee and Texas; nearly 40 apparently belong to *Peridermium carneum* and the remainder to *Peridermium elephantopodis.*

Arthur and Kern (3) in 1906 described *Peridermium intermedium* from specimens collected on the needles of *Pinus echinata* by C. H. Demetric at Perryville, Missouri. The description of the species agrees in part with that of *Peridermium carneum* and in part with that of *Peridermium elephantopodis* as given by us earlier in this paper based on specimens on *Pinus caribaea* grown from artificial cultures at Washington, D. C. It is not wise to assign the type collection of *Peridermium intermedium* at present to either of these species, since we have never had the opportunity to section and examine aecia of the type collection. We have, however, sectioned and examined part of the exsiccati which had previously been examined and assigned to *Peridermium intermedium* either by Arthur or by Kern, which we assign as follows: Collection by H. von Schrenk, Eureka Springs, Arkansas, May 23, 1906 (1101) belongs to *Coleosporium elephantopodis;* collections in North Carolina by H. von Schrenk (1099) and C. D. Howe (20718) and R. P. Dale, Okay, Arkansas (15353) belong to *Coleosporium carneum.* There is always the possibility that any older collection may have two species inter-

mixed, and since we sectioned different aecia from those studied by Arthur and Kern, we may have examined a different species. The following species of *Peridermium* are now known to occur on *Pinus echinata*, viz.: *P. acicolum*, *P. carneum*, *P. delicatulum*, *P. elephantopodis*, *P. inconspicuum*, *P. ipomeae*, and *P. terebinthinaceae*, and the occurrence of more than one of these species on the same tree has often been noted by the senior writer.

Data on the Period of Fruiting in Foliicolous Species of Peridermium on Pine

The period for fruiting among foliicolous species of *Peridermium* on pine based upon the results of a large number of observations and experiments in infections is as follows: Infections take place as soon as the telia are mature on the alternate host. This begins much earlier in Florida than farther north, since the aecia and telia both mature at least two months earlier in Florida than at Washington, D. C., and three months earlier than in the mountains of Pennsylvania and in regions farther north. Aecia are mature in Florida from February to April, and telia from the middle of May to July or even later, varying with the species. Around Washington, D. C., aecia are found from April to June and telia from July to September or later. Inoculations with telia made at Washington, D. C., in September and October produce mature pycnia in two or three months and mature aecia on the same areas adjacent to the pycnia four to five months after infection. As a rule, a second crop of either pycnia or aecia is not produced in artificial infections, but four instances of deferred fruiting, one with *Peridermium acicolum*, and three with *Peridermium carneum* have been noted, in which pycnia and aecia were formed the second year following the time of inoculation. In Florida, however, the senior writer has frequently observed both *Peridermium carneum* and *P. ipomoeae* on *Pinus palustris*, bearing a second crop of aecia on the margins of old infections which had borne aecia the previous year.

New Hosts for Species of Coleosporium

The following aecial hosts for species of *Coleosporium* are reported in this paper for the first time on species of *Pinus:*

C. carneum on *P. mayriana.**

C. delicatulum on *P. coulteri.**

C. elephantopodis on *P. canariensis,** *P. contorta,** *coulteri,** *P. radiata** and *P. serotina.**

C. inconspicum on *P. palustris* at Styx, near Columbia, South Carolina.

C. ipomoeae on *P. serotina* from *Styx,* South Carolina.

C. solidaginis on *P. coulteri.**

C. terebinthinaceae on *P. serotina,* Clearwater, South Carolina.

Peridermium floridanum on *P. palustris,* Ocala, Florida.

The following uredinial and telial hosts for species of *Coleosporium* are now reported for the first time in the United States:

C. elephantopodis on *Elephantopus elatus,* District of Columbia, Georgia and Mississippi.

C. helianthiae on *Helianthus tomentosus* and *H. tuberosus,* Virginia.

C. ipomoeae on *Pharbitis cathartica,* Florida.

C. laciniariae on *Laciniaria elegantula,* Alabama; on *L. gracilis,* Florida; on *L. laxa,* Florida; on *L. squarrulosa,* Arkansas, Georgia, and Tennessee; on *L. tenuifolia,* Florida.

C. minutum on *Adelia ligustrina,* District of Columbia* and Florida.

C. ribicola, on *Grossularia cynosbati,* Wisconsin; on *G. innominata** and *G. reclinata,* District of Columbia.*

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NOTAE MYCOLOGICAE, SER. XXIX

Micromycetes Dakotenses et Utahenses a Doct. J. F. Brenckle Lecti et Communicati

P. A. Saccardo

A. Teleomycetae

1. Rosellinia amphisphaerioides Sacc. et Speg., Syll. **I**: 262, F. Ital. *fig. 588*

Hab. in ramis putrescentibus *Ribis floridani*, Kulm, N. D., Oct., 1916 (1205).

Asci 100 × 7–8, stip. 20–26 μ longis; sporidia 1-sticha 17–21 × 7–8, fuliginea, senio longitrosum rimosa ut in *Anthostomate taeniosporo*. Esse potest forma, a loco sub cortice relaxato, deminuta et deformata, *R. mastoideae* Sacc.

2. **Rosellinia subsimilis** Sacc., sp. nov.

Peritheciis gregariis, subglobosis, minutis, nigris, glabris, 100–180 μ diam. brevissime papillatis; ascis filiformi-paraphysatis, cylindricis, subsessilibus, 89–90 × 5.5–6, 8-sporis; sporidiis oblique monostichis e cylindraceo ellipsoideo-oblongis, saepius leviter inaequilateris, utrinque rotundatis, 12–14 × 5–6, fuligineis.

Hab. in ramis decorticates emortuis *Crataegi* sp. Whitestone Gully,[1] N. D., Nov., 1916 (1188). Affinis *R. rimincolae* differt sporidiis angustioribus subcylindraceis, etc.

3. Melanopsamma pomiformis (Pers.) Sacc., Syll. **I**: 575

Hab. in ramis putrescentibus *Corni stoloniferae*. Whitestone Gully,[1] N. D., Nov., 1916 (1185). Specimina immatura et non omnino certa.

4. Didymella eupyrene Sacc., Syll. **I**: 554

Hab. in caulibus putrescentibus *Urticae gracilis*, Ft. Douglas, Utah, Majo, 1918 (53).

1 Whitestone Gully extends from and lies east of the U. S. Monument of "Whitestone Battlefield" in Dickey County.

5. DIDYMELLA EFFUSA (Niessl) Sacc., Syll. I: 552

Hab. in caule emortuo *Artemisiae biennis,* Kulm, N. D., Sept., 1914 (632). Forma ascis 60–70 × 7, sporidiis breviter fusoideis, 12–15 × 4, plasmate bipartito 1-septatis, vix constrictis.

6. MELANOMMA MEDIUM Sacc. et Speg., Syll. II: 104

Hab. in ramis decorticatis putrescentibus *Sambuci glaucae,* Ft. Douglas, Utah, Apr., 1918 (70).

Asci 90–100 × 14; sporidia disticha v. oblique 1-sticha, tereti-oblonga, utrinque rotundata, 22–25 × 7–8, 3-septata, leviter constricta, dilute brunnea.

7. TEICHOSPORA SOLITARIA Ellis, Pyr. N. Amer., p. 214, *Cucurbitaria* Ell. Syll. II: 321.

Hab. in trunco decorticato et intemperie indurato *Atriplicis confertifoliae,* Grantville, Utah, Apr., 1918 (32).

Valde affinis est *T. oxythele* Sacc. et Briand. Syll. IX: 903. Berl. *Ic. II, t. 74.*

8. PLEOSPORA SHEPHERDIAE Peck., Syll. IX: 876

Hab. in ramis corticatis emortuis *Shepherdiae argenteae,* Whitestone Gully, N. D., Nov., 1918 (1192).

9. HYPOXYLON EFFUSUM Nits., Syll. I: 379

Hab. ad ligna putrescentia, Fort Riley, Kans., Oct., 1917 (101).

Phaeotrype Sacc., gen. nov. (Etym. quasi *Diatrype phaeospora*)

Stromata pulvinata, erumpenti superficialia, nigra, ostiolis vix exantibus punctulata; perithecia pauca monosticha, substantia discolori excepta. Asci breviter stipitati, octospori, aparaphysati (?). Sporidia allantoidea, majuscula, atro-olivacea. Est omnino *Diatrype* sed vere phaeospora.

10. **Phaeotrype Brencklei** Sacc., sp. nov.

Stromatibus gregariis, subsuperficialibus, peridermii laciniis basi cinctis, depresso pulvinatis, atro-nitidulis, 0.5 × 0.7 mm.

diam., superficie levissime colliculosa et punctata; intus sordide albido, carnosulo; peritheciis 8–10 monostichis, globulosis, 0.3 mm. diam., ostiolis punctiformis, obtusis, integris; ascis fusoideis breviter stipitatis, 80–85 × 8–9, octosporis; sporodiis distichis allantoideis curvis, utrinque rotundatis; 16–17 × 3.5–4, atro-olivaceis, subnigricantibus.

Hab. in ramis corticatis emortuis *Rosae* sp., Whitestone Gully, N. Dak., Nov., 1916 (1198).

11. **Diatrype paurospora** Sacc., sp. nov.

Stromatibus gregariis, erumpenti-superficialibus, peridermo cinctis, pulvinatis, nigris, duris, fragilibus, superficie colliculosis v. rimosis, 1–2 mm. diam.; peritheciis paucis, globosis, 0.3 mm. diam., substantia sorde grisea exceptis; ostiolis vix excedentibus obtusis; ascis fusoideis, apice rotundatis, 35–40 × 7, subsessilibus, aparaphysatis (?), 2–4-sporis; sporidiis allantoideis, curvulis, utrinque rotundalis, 16 × 4–5, hyalinis, vix chlorinis, tunica crassiuscula.

Hab. in ramis corticatis emortuis *Quercus utahensis* pr. Ft. Douglas, Utah, Jan., 1918 (12). Imprimis ascis tantum 2–4-sporis distinguenda species.

12. EUTYPA SCABROSA (Bull.) Fuck., Syll. **I**: 171

Hab. in ramis emortuis corticatis et decorticatis *Amelanchieris alnifoliae,* Whitestone Gully, Nov., 1916 (1199).

13. EUTYPA LEIOPLACA (Fr.) Cooke, Syll. **I**: 170

Hab. in ramis decorticatis emortuis *Amelanchieris alnifoliae,* Whitestone Gully, Nov., 1916 (1182). Socia adest forma diminuta *Calosphaeriae Principis.* Specimena *Eutypae* juvenilia et tunc dubium an potrius *Eutypam latam* spectent.

14. EUTYPELLA SARCOBATI Ellis et Ev., Syll. **XIV**: 484

Hab. in ramis corticatis *Sarcobati vermiculati,* Salt Lake pr. Grantville, Utah, Apr., 1918 (29). Superficiis ligni late mycelio atrata, hinc speciis ad *Eutypam* nutat.

15. VALSA CORNICOLA Cooke, Syll. I: 122

Hab. in ramis corticatis emortuis *Corni stoloniferae*, Whitestone Gully, N. D., Nov., 1916 (1184). Est forma minor.

16. VALSA CINCTA Fr., Syll. I: 142

Hab. in ramis corticatis *Amelanchieris?*, Whitestone Gully, Nov., 1916 (1183a).

17. VALSA LEUCOSTOMA (Pers.) Fr., Syll. I: 139

Hab. in ramis corticatis *Pruni melanocarpi*, Ft. Douglas, Utah, Jul., 1918 (85). Specimina non bene evoluta.

18. **Chorostate utahensis** Sacc., sp. nov.

Stromatibus erumpentibus, prominulis pulvinatis, 1.5 mm. diam., nigricantibus; peritheciis numerosis, monostichis, 0.3 mm. diam., globosis, ostiolis punctiformibus, vix extantibus; ascis cylindraceis apice rotundatis, ibique non v. vix lumine bifoveolatis, breviter stipitatis, $55–60 \times 7.3–8$, aparaphysatis, octosporis; sporidiis oblique monostichis, oblongo-clavatis, curvatis, $12–14 \times 3–6$, eguttulatis, hyalinis, constricto-1-septatis.

Hab. in ramis corticatis emortuis *Quercus utahensis*, Ft. Douglas, Utah, Majo, 1918 (94). Affinis *C. teiphaemae*, differt sporidiis curvis, loculo super crassiore rotundato, ascis angustioribus, ostiolis abbreviatis.

19. **Diaporthe (Euporthe) Brenckleana** Sacc., sp. nov.

Peritheciis laxe gregariis, ligno immutato sed linea stromatica percurso immersis, globosis, 350–500 μ diam., contextu minute celluloso atro-olivaceo; ostiolis erumpentibus tereti-conicis parum extantibus; ascis fusoideis, apice rotundatis, $45–55 \times 8–9$, aparephysatis, octosporis; sporidiis oblique 1-stichis, cylindraceo-fusoideis, utrinque rotundatis, 14×3.6, inaequaliter 4-guttulatis, hyalinis, leviter constrictis.

Hab. in ramis corticatis, interdum superficie atratis, *Corni stoloniferae*, Whitestone Gully, N. D., Nov., 1916 (1186). A *D. crassicoli* ostiolo omino diverso, etc. secedit.

20. FENESTELLA MINOR Tul., Syll. **II**: 326

Hab. in ramis corticatis emortuis *Corni stoloniferae,* Whitestone Gully, N. D., Nov., 1916 (1194). Asci 100–120 × 10–12, p. spor. 80–85 μ longa, plerumque 4-spori; sporidia 6–10-septato-muralia, 25–30 × 9–11, fuliginea; stromata valsea.

21. **Lachnum crystalligerum** Sacc., sp. nov. (mox endenda)

Hab. in ramis corticatis emortuis *Rubi parviflori,* Ft. Douglas, Utah, Jul., 1918 (81). Specimina non omnino matura.

22. PYRENOPEZIZA RUBI (Fr.) Rehm., Syll. **VIII**: 361

Hab. in ramis emortuis *Rubi strigosi,* Kulm, N. D., Sept., 1916 (1190).

23. ORBILIA VINOSA (A. et S.) P. Karst., Syll. **VIII**: 622

Hab. in lignis putridis pr. Anselm, N. D., Aug., 1916 (1072).

24. CENANGIUM FURFURACEUM (Roth.) De Not., Syll. **VIII**: 565

Hab. in ramis corticatis emortuis *Ceanothi velutini,* Ft. Douglas, Utah, Apr., 1918 (39). Probabiliter haec species, sed specimina imperfecta et tunc paullulum dubia.

25. **Patinella Brenckleana** Sacc., sp. nov.

Ascomatibus gregariis, subsuperficialibus, scutellatis, applanatis, 0.7–1 mm. diam., nigris, glabris, margine rectiusculo, acuto, disco plano intus flavido, epithecio vero grumoso, atro-fulvo; ascis tereti-clavatis, apice rotundatis, deorsum sensim tenuato-stipitatis, 70 × 11–12, octosporis; sporidis distichis, fusoideis, saepe leniter curvis, utrinque obtusatis, dilutissime flavidis, farctis; paraphysibus filiformibus, hyalinis.

Hab. in cortice *Amelanchieris alnifoliae,* Whitestone Gully, N. D., Nov., 1916 (1196). Affinis *P. inquinanti* a qua differt ascomate 1 mm. lato, disco plano, sporidiis paullo minoribus, paraphysibus aequalibus.

B. DEUTEROMYCETAE

26. SPHAERONAEMA POLYMORPHUM Auersw., Syll. III: 185

Hab. in ramis corticatis *Pruni melanocarpae*, Ft. Douglas, Utah, Nov., 1917 (4). Dicitur status pycnid. *Cenangellae vernicosae* (Fuck.) Sacc.

27. DIPLODIA ABROTANI Fuck., Syll. Syll. III: 369

Hab. in caulibus emortuis *Artemisiae abrotani*, cultae, Kulm, N. D., Jan., 1917 (1207). Sporulae ovato-ellipsoideae, 20–24 × 11, diu continuae (ut *Sphaeropsis*) denique obsolete 1-septatae, sporophora interdum in pseudoparaphyses 20–30 × 1.5–2 hyalinas abeunt.

28. **Septoria Lunelliana** Sacc., sp. nov.

Pycnidiis gregariis globoso-depressis, epidermide initio velatis, 180 μ diam. subastomis, dein late dehiscentibus et collabescentibus, extus nigricantibus; contextu fulvo-brunneo, celluloso; sporulis filiformibus, rectis v. curvulis, utrinque acutulis, 65–75 × 2.3–2.5, hyalinis, obsolete-3-septatis, guttulatisque.

Hab. in foliis languidis expallentibus *Caricis atrostachyae* pr. Leeds, N. D., Jul., 1915 (J. Lunell, n. 1206). A *Septoriis* caricicolis praecipue pycnidiis contextu fulvescentibus, collabescebtibus, sporulis aequalibus, obsolete 3-septatis dignoscitur.

29. **Melanconium botryosum** Sacc., sp. nov.

Acervulis erumpentibus, gregariis, nigris, peridermio laciniato cinctis, ob conidia expulsa et compacta superficie colliculoso-botryosis (sphaeriae-formibus); conidiis copiosissimis, globosis. levibus, 7–8 μ diam., ochraceo-fuligineis; conidiophoris papilliformibus, exiguis ex hypostromate celluloso, ochraeo-fusco orientibus.

Hab. in ramis corticatis emortuis *Pruni melanocarpae*, Ft. Douglas, Utah, Nov., 1917 (3). Typus singularis et vix *Melanconio* proximus, probibiliter gen. nov.

30. **Steganosporium utahense** Sacc., sp. nov.

Acervulis gregariis, subcutaneo-erumpentibus, sed non praeminentibus, 1 mm. diam., primo peridermio bullato tectis, dein ab

ejus laciniis pallidis cinctic, nigricantibus, subceraceis; conidiis polymorphis e globoso-angulosis, v. triangulis, v. gibbis, 24–31 μ diam., ex cellulis 3–10, botryoideo-conjunctis formatis, rufo-fuligineis; conidiophoris paliformibus saepe 1-septatis, subhyalinis, 28×8–9, ex hypostromate crasso distincte celluloso rufo-fusco oriundis.

Hab. in ramulis corticatis emortuis *Chrysothamni nauseosi,* Ft. Douglas, Utah, Apr., 1918 (27). Affine *S. heterospermo* Vesterg sed acervulis initio epidermide albida pustulata tectis, dein cinctis, conidiis non foedantibus, conidiophoris distinctis paliformibus, etc. dignoscitur.

31. DENDRYPHIUM NODULOSUM Sacc., Syll. **IV**: 490.

Hab. in caulibus emortuis putridis *Urticae gracilis,* Nyland's Grove, Lamoure County, N. D. (1181). Probabiliter *Helminthosporium interseminatum* B. et Br. vix differt.

32. EPOCHNIUM ISTHMOPHORUM Sacc., sp. nov. (mox endenda)

Hab. in caulibus emortuis *Chrysothamni nauseosi,* Ft. Douglas, Utah, Apr., 1918 (34). Genus *Epochnium* non tantum ad *Diplococcium* nutat sed et forte propius ad *Bisporam.* Conidia isthmo saepius connexa, usque ad 20–24×11–12.

33. CYLINDROCOLLA URTICAE (Pers.) Bon., Syll. **IV**: 674.

Hab. in caulibus *Urticae* emortuis, Ft. Douglas, Utah, Majo, 1918 (54).

VIA LUCA BELLUDI, 15,
PADOVA, ITALY.

MONOGRAPH OF THE CORYNELIACEAE

Harry Morton Fitzpatrick

(With Plates 12–18, and Table I)

The Coryneliaceae have not been critically investigated, and a monograph of the species of the world has never been prepared. Since the majority of the species occur only in tropical or subtropical regions they have been collected only occasionally. Consequently few even of the larger herbaria contain more than a meager representation of them. The present paper is based largely on material obtained through correspondence with students of mycology in many parts of the world. The investigation was begun in the summer of 1917 at the New York Botanical Garden when the specimens in the herbarium there were examined. Subsequently considerable additional material has been obtained from other American herbaria, and from many foreign sources. Marked good fortune has been experienced in obtaining type and other authentic specimens for study. The original material of almost every species has been examined. More than 130 specimens have been studied during the progress of the investigation, and the herbarium of the writer contains in excess of 80 numbers. Many institutions and individuals have cooperated in making available their herbarium and library facilities.

The writer wishes especially to acknowledge his obligation to Doctor W. A. Murrill, Doctor F. J. Seaver, and Doctor J. H. Barnhart of the New York Botanical Garden for their uniform courtesy and spirit of cooperation during his stay there. He is particularly indebted also to Professor W. G. Farlow, and Professor R. Thaxter who made available to him all the material in the herbarium at Harvard University. An excellent collection of twenty specimens from the herbarium of the Union Department of Agriculture at Pretoria, South Africa, was received from Miss Ethel M. Doidge. Additional interesting South African material was sent by Professor P. van der Bijl from the Natal

herbarium at Durban. Professor L. Romell mailed for examination seventeen specimens representing all the collections of Coryneliaceae in the herbarium of H. Rehm at Stockholm. He also forwarded from the herbarium of Sydow type material of *Corynelia carpophila* Syd., and *C. clavata* form *macrospora* Syd., and sent from the herbarium of the Royal Museum at Stockholm several valuable specimens including a portion of the original material of *C. oreophila* (Spegazzini) Starbäck. Mrs. Flora W. Patterson and Miss Vera K. Charles have made available all the material of the Coryneliaceae in the herbarium of the Bureau of Plant Industry at Washington, D. C., and Doctor Charles Fairman has loaned for examination all the material in his herbarium at Lyndonville, N. Y. The writer is also indebted to Professor L. Mangin, curator in the Museum d' Histoire Naturelle at Paris for type material of *Coryneliella consimilis* Hariot & Karsten; to Professor N. Patouillard of Neuilly-sur-Seine for type material of *Capnodium fructicolum* Patouillard; to Doctor A. D. Cotton of the Royal Botanic Gardens at Kew for type material of *Capnodium maximum* Berkeley & Curtis, *Sphaeronema subcorticale* Cooke & Ellis, and *Corynelia nipponensis* n. sp.; to Professor Carlos Spegazzini for authentic material of *Alboffia oreophila* Spegazzini; to Mr. Elam Bartholomew of Stockton, Kansas, for type material of *Corynelia brasiliensis* n. sp.; to Professor F. L. Stevens of Illinois University for type material of *C. clavata* var. *portoricensis* Stevens; to Professor S. F. Ashby, Microbiologist at Kingston, Jamaica, for type material of *C. jamaicensis* n. sp., to Doctor H. D. House of Albany, New York, for type material of *Caliciopsis pinea* Peck, to Professor O. Juel of Upsala, Sweden, for information concerning the type material of *Corynelia uberata* Fries and to Miss E. M. Wakefield of the Royal Botanic Gardens at Kew for information concerning the type material of *Corynelia tripos* Cooke and a specimen labelled *Mucor clavatus* in the herbarium of Linnaeus. Excellent material of various species has also been received from Professor G. Yamada, Morioka, Japan; Professor Elmer D. Merrill, Manila, Philippine Islands; Professor F. J. F. Shaw, Pusa, India; Mr. John A. Stevenson, Rio Piedras, Porto Rico; Professor Otto A. Reinking,

Los Banõs, Philippine Islands; Mr. Edwin B. Copeland, Chico, California; Professor H. S. Jackson, Purdue University; Doctor E. W. Olive, Brooklyn Botanic Garden; and Professor H. H. Whetzel, Cornell University.

Through the courtesy of Mr. Percy Wilson, the writer was allowed to examine all of the mounted specimens of *Podocarpus* in the phanerogamic herbarium of the New York Botanical Garden, and more than a dozen specimens of *Corynelia* which had been accidentally collected were found there. Professor A. J. Eames of Cornell University examined in like manner all of the material of *Podocarpus* in the Gray herbarium at Harvard University and obtained several valuable specimens. A similar search was made by Doctor S. M. Zeller in the herbarium of the Missouri Botanical Garden, and by Miss Vera K. Charles in the herbarium of the National Museum at Washington, D. C. A considerable number of valuable specimens were obtained in this way and the writer wishes to express his appreciation of the aid given him in this search. All the possibilities known to the writer for obtaining material of the group for study have been exhausted, and he feels that no additional material, the examination of which would contribute materially to the completeness of this paper, is available to him. Nevertheless it is probable that in those tropical countries in which fungi have been little studied, other species of the group will be discovered. It is hoped that the publication of this paper will stimulate the search for these forms. Finally the writer wishes to express his indebtedness to Professor H. H. Whetzel for the suggestion that the monograph be prepared, and for aid and encouragement given during the progress of the investigation. Thanks are also due to Mr. W. R. Fisher for the care taken in the preparation of the photographs which illustrate the paper, and to Mr. C. E. Chardon who, under the writer's immediate direction, prepared the plate of drawings and the phyllogenetic chart which occurs in the text.

SYSTEMATIC RELATIONS OF THE CORYNELIACEAE

The family Coryneliaceae was erected in 1891 by Saccardo (45) to embrace the two genera Corynelia and Tripospora. As orig-

inally constituted it contained only two species, *Corynelia uberata* Fries and *Tripospora Cookei* (Cooke) Saccardo. The family diagnosis reads: "*Perithecia coriacea, atra, lageniformia, ostiolo elongato, apice perforato, dein late infundibuliformiter expanso.*" In 1895 Saccardo (45) included in the family the genus *Coryneliella* represented by the single species *C. consimilis* Hariot & Karsten.

Lindau (28) in his treatment of the Sphaeriales includes in the Coryneliaceae the three genera *Corynelia, Coryneliella,* and *Tripospora,* and states that each is monotypic. Subsequently, Saccardo (45) has recorded the discovery and description of several additional species of *Corynelia.* Lindau regards the family as closely related to the Cucurbitariaceae, and emphasizes the fact that the two are alike in having the perithecia seated on a stroma. In his discussion of the Coryneliaceae, he states that the perithecium is flask-shaped with a long neck dilated at the apex and provided with a broad funnel-shaped mouth. The flask-shaped character of the perithecium is used by him to separate the Coryneliaceae from the Cucurbitariaceae, the perithecium in the latter family being more or less definitely globose.

It will be noted that both Saccardo and Lindau describe the perithecium as ostiolate, and as typical, therefore, of the Sphaeriales. Their statements in this connection are evidently based largely on the observations of Winter (55) on *Corynelia uberata* and *Tripospora tripos.* Cooke (8), however, from the examination of material of *Corynelia uberata* was led to place the genus *Corynelia* in the Perisporiaceae between *Capnodium* and *Antennaria,* and states that the perithecium is "wholly closed, hence without a mouth and irregularly split."

The writer's own observations show that the Coryneliaceae lack the typical ostiolum present in the Sphaeriales, and he sees no reason for regarding the group as closely related to the Cucurbitariaceae. The perithecium on the other hand cannot be correctly described as lacking a mouth or as irregularly split. In all the known species of the perithecium in the young condition is wholly closed, but at maturity it ruptures at the apex in a definite manner. In certain of the species, which the writer believes to

represent the more primitive condition, the perithecium ruptures at maturity in such a manner that the apex becomes fimbriate-lacerate, the hyphal elements pulling apart and recurving to form a fringe about a funnel-shaped opening. In other species, which evidently represent a more specialized and higher type of development, the perithecium is definitely and deeply cleft at the apex. In some of these cases a single cleft is formed; in others, the apex of the perithecium splits in a radial manner, three or more definite lobes resulting. In *Corynelia tropica* a single deep cleft is formed accompanied by a more or less evident fimbriate-laceration of the two lobes. This species possesses, therefore, an intermediate type of dehiscence. Since in several species of *Corynelia* the line of dehiscence follows wholly evident and prominent grooves which exist in the perithecium, even in the young condition, the type of dehiscence can certainly not be termed indefinite. At the same time the term ostiolum has not been applied to an opening as large as that which results in this case where in some species the whole interior of the perithecium is exposed. It might be assumed that an approach to this condition is found in the Sphaeriales in the Lophiostomataceae where an elongated slit-like mouth is termed the ostiolum. In this case, however, the opening is absolutely definite and small and never enlarges to expose the interior of the perithecium as in some of the Coryneliaceae.

Two species, *Corynelia fructicola* and *Sorica maxima*, embraced in this monograph were originally described as members of the genus *Capnodium* of the Perisporiaceae. They differ from other species of this genus in their possession of a definite erumpent stroma and in the absence of aerial mycelium. Moreover the characters of their perithecia, asci, and spores indicate that they are closely related to the species embraced in the genus *Corynelia*. Nevertheless it is evident that not only the genus *Capnodium* but also certain other genera of the Perisporiaceae possess many characters in common with the Coryneliaceae, and it has become increasingly evident that the two groups are closely related. The species of *Caliciopsis* have not been previously considered as members either of the Perisporiaceae or the Coryneliaceae. They

are, however, certainly closely related to *Sorica maxima*, and this species in turn possesses so many characters in common with *Corynelia fructicola* that it cannot easily be excluded from the Coryneliaceae. The genera *Sorica* and *Caliciopsis* may perhaps be regarded as transition forms between the Perisporiaceae and the Coryneliaceae, but their possession of an erumpent stroma and the definite apical dehiscence of the perithecium makes necessary their inclusion in the Coryneliaceae as delimited in this monograph. The characters of their asci and spores indicate, moreover, a close relationship with the species of *Corynelia*.

The Perisporiales are separated from the Sphaeriales chiefly on the basis of the difference in the method of dehiscence of the perithecium. Lindau (28) states that in the Sphaeriales the perithecium is provided with a definite ostiolum, while in the Perisporiales there is developed either a more or less globose, cleistocarp perithecium completely inclosing the asci and at maturity irregularly dehiscent, usually through disintegration (Erysiphaceae, Perisporiaceae), or a shield-shaped, imperfectly developed perithecium in some species dehiscent at the center by a circular pore (Microthyriaceae). In some species of the Perisporiaceae, however, the perithecium dehisces more or less definitely at the apex either by a small number of radial splits forming prominent lobes or by the method of fimbriate-laceration characteristic of *Caliciopsis, Sorica, Tripospora,* and *Corynelia fructicola*. On the other hand a few species of the Chaetomiaceae and Sordariaceae of the Sphaeriales fail to develop the usual ostiolum and dehisce irregularly.

The most constant characteristic of the Perisporiales is the production of superficial perithecia on aerial mycelium. These fungi cannot be said to differ essentially in this respect, however, from the Chaetomiaceae or other lower groups of the Sphaeriales. Moreover in the Perisporiales the existence of such forms as *Oidiopsis taurica* (Salmon 46) shows that even in this group the mycelium is not necessarily always superficial. A consideration of all these facts concerning the method of dehiscence of the perithecium, combined with a comparative study of the general morphology of the fungi embraced in the Perisporiales raises the

question whether or not these forms really comprise a natural order. On account of the tropical distribution of many of the species our knowledge of the Perisporiaceae and Microthyriaceae is recognized to be very imperfect, and it may be safely assumed that further study will result in pronounced changes in their classification. It is possible that many of the species embraced in the Perisporiaceae are more closely related to the Sordariaceae and other lower Sphaeriales than they are to the Microthyriaceae, many of which in turn might well be relegated to the Phacidiales. The genus *Diplocarpon,* as pointed out by Wolf (56) may indeed be regarded as furnishing a transition to this group.

The Sphaeriales, on account of their possession of a definite ostiolum may be assumed to be more highly developed than the Perisporiales. Still it is probable that they had their origin in fungi similar to the Perisporiaceae, and perhaps developed from these along several different lines.

The Coryneliaceae as constituted in the present paper cannot be placed with entire satisfaction either in the Sphaeriales or in the Perisporiales as delimited by Lindau and other authors. The absence of superficial mycelium and the development of the perithecia on an erumpent stroma render them unlike the Perisporiales, while the absence of a true ostiolum excludes them from the Sphaeriales. The problem is further complicated by the existence in the single genus *Corynelia* of two distinct types of dehiscence. In this connection it should be noted that although the more primitive of the two sorts of dehiscence has its counterpart in certain of the Perisporiaceae, the other and clearly more specialized method is wholly unlike anything hitherto described for any of the pyrenomycetes. A consideration of all the available data in the light of the questions involved makes it evident that the grounds for the inclusion of the Coryneliaceae among the higher Sphaeriales in the neighborhood of the Cucurbitariaceae are wholly untenable. These fungi are clearly of an essentially different and more primitive type. They are probably more closely related to the Perisporiaceae than to any other group, and their development of a unique type of dehiscence indicates an ancient origin.

The incorporation of the Coryneliaceae in the Perisporiales will necessitate some widening of the limits of this order, but this is probably at present the most logical disposition of the group. Since all the species lack aerial mycelium and bear their perithecia and pycnidia on an erumpent stroma, they differ essentially from the Perisporiaceae and clearly comprise a separate family. When the forms included by Lindau in the Perisporiaceae are more critically studied and the method of dehiscence in all of them is clearly understood, it is probable that the line of separation between the two families can be drawn with greater definiteness than at present.

INTER-RELATIONSHIPS OF THE SPECIES WITHIN THE FAMILY

A comparative study of the various species in the family has led to some interesting conclusions concerning the phyllogeny of the group as a whole. It has also made clear the general line of development of the more highly specialized species from the lower more generalized ones. The accompanying chart gives in detail the writer's conception of the evolution of these forms.

Certain characters of the ancestral stock from which the Coryneliaceae of the present arose are easy to surmise. These ancestral forms evidently resembled in many respects the fungi now included in *Capnodium*. They had acquired, however, a pronounced tendency toward the parasitic habit, possessed internal rather than aerial mycelium, and bore their perithecia in a cespitose cluster on a definite erumpent stroma. We may assume also that the perithecium was elongated in form, probably definitely stalked, and that dehiscence was apical and of the type termed fimbriate-lacerate. The perithecium was further characterized by the absence of paraphyses and by the production of broadly ovoidal, long-stipitate, 8-spored asci with unicellular, spherical to oval spores. The species of *Caliciopsis* regarded by the writer as the most primitive members of the group now extant, have departed from this type relatively little. Other members of the family apparently somewhat less primitive in type are *Sorica maxima*, *Tripospora tripos*, and *Corynelia fructicola*. These species have resulted from development along very different lines.

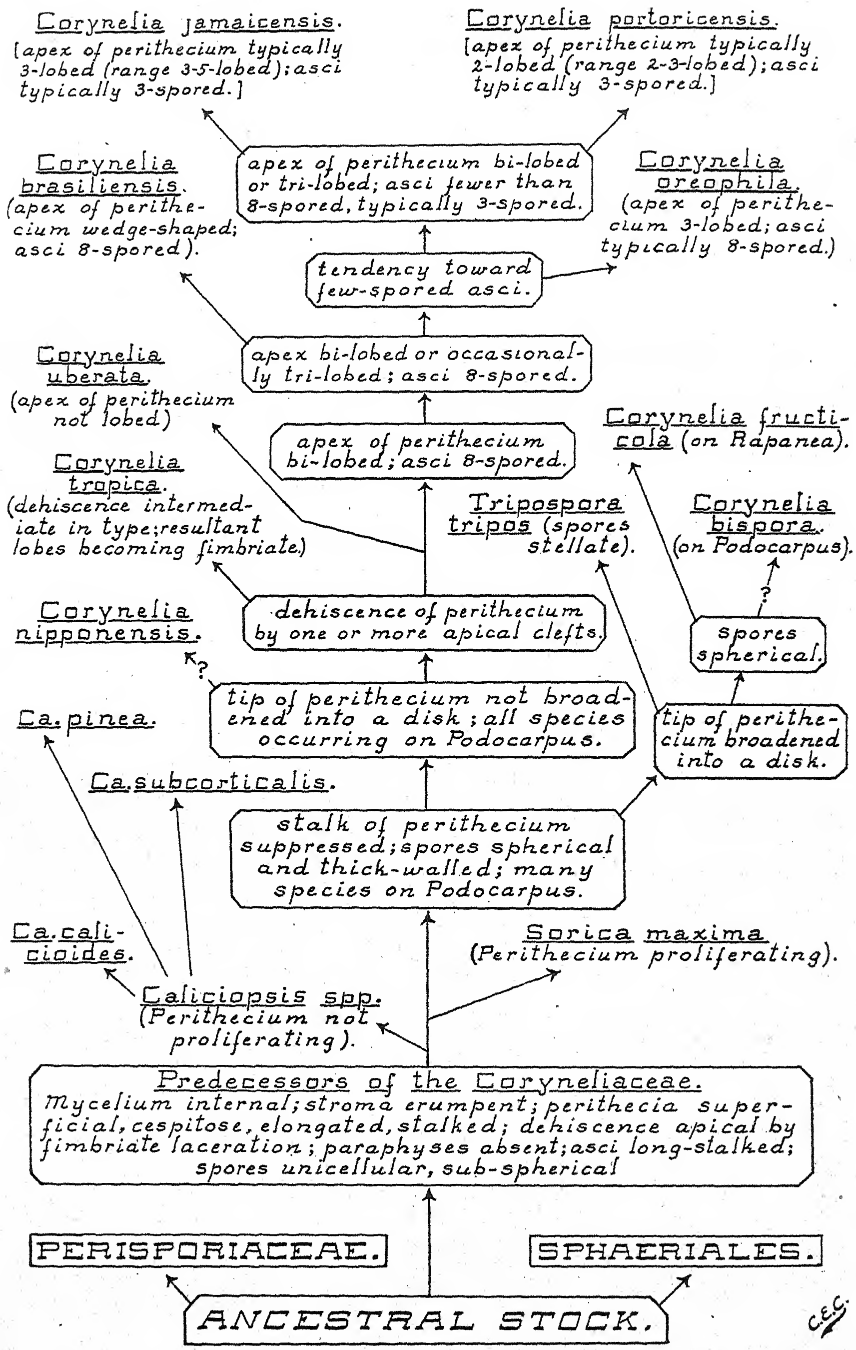

Corynelia jamaicensis.
[apex of perithecium typically 3-lobed (range 3-5-lobed); asci typically 3-spored.]
Corynelia portoricensis.
[apex of perithecium typically 2-lobed (range 2-3-lobed); asci typically 3-spored.]
Corynelia brasiliensis. (apex of perithecium wedge-shaped; asci 8-spored).
apex of perithecium bi-lobed or tri-lobed; asci fewer than 8-spored, typically 3-spored.
Corynelia oreophila. (apex of perithecium 3-lobed; asci typically 8-spored.)
tendency toward few-spored asci.
apex bi-lobed or occasionally tri-lobed; asci 8-spored.
Corynelia uberata. (apex of perithecium not lobed)
apex of perithecium bi-lobed; asci 8-spored.
Corynelia fructicola (on Rapanea).
Corynelia tropica. (dehiscence intermediate in type; resultant lobes becoming fimbriate.)
Tripospora tripos (spores stellate).
Corynelia bispora. (on Podocarpus).
?
Corynelia nipponensis.
dehiscence of perithecium by one or more apical clefts.
spores spherical.
?
Ca. pinea.
tip of perithecium not broadened into a disk; all species occurring on Podocarpus.
tip of perithecium broadened into a disk.
Ca. subcorticalis.
stalk of perithecium suppressed; spores spherical and thick-walled; many species on Podocarpus.
Ca. calicioides.
Sorica maxima (Perithecium proliferating).
Caliciopsis spp. (Perithecium not proliferating).
Predecessors of the Coryneliaceae.
Mycelium internal; stroma erumpent; perithecia superficial, cespitose, elongated, stalked; dehiscence apical by fimbriate laceration; paraphyses absent; asci long-stalked; spores unicellular, sub-spherical
PERISPORIACEAE.
SPHAERIALES.
ANCESTRAL STOCK.
C.E.C.

TABLE I

In *Sorica maxima* the perithecium resembles that in *Caliciopsis* but has the ability to proliferate in a remarkable manner, a new perithecium being developed at the tip of the old. In *Tripospora tripos* and *Corynelia fructicola* the perithecium dehisces as in *Caliciopsis* and *Sorica*, but the long stalk of the perithecium is absent, and in form and habit the species more closely approximate the more highly developed members of the group. These two species are remarkably similar in the general appearance of the perithecium, which is flask-shaped with a long, narrow neck dilated at the apex to form a broad, flat disc. They differ chiefly in the character of their spores. The existence of the peculiar, stellate spores in *Tripospora tripos* is difficult to explain. No other species in the family shows a tendency toward the development of this stellate character, the brown, oval or spherical spores being remarkably similar throughout the group. The occurrence of *Corynelia fructicola* on *Rapanea* and the occurrence of *Tripospora tripos* on *Podocarpus* is noteworthy. Since all of the other species of *Corynelia* occur on *Podocarpus* it seems logical to conclude that the ancestral stock had become restricted to this host before the stellate spores of *Tripospora* appeared. Otherwise the occurrence of *Tripospora* on *Podocarpus* must necessarily be regarded as a coincidence.

The most primitive species in which dehiscence of the perithecium by an apical split occurs is probably *Corynelia tropica*. *Corynelia uberata* shows this type of dehiscence slightly more highly developed. In *Corynelia tropica* the apical split is accompanied by fimbriate-laceration of the resultant lobes, the transition to the more primitive condition thus being shown. Dehiscent perithecia of *C. bispora* and *C. nipponensis* have not been seen, but the probable position of these species in the phyllogeny of the group as indicated by other characters is shown in the accompanying chart. In none of these species is the apex of the perithecium lobed.

It may be safely assumed that a perithecium definitely lobed at the apex shows in this respect a more recent modification than one with the more usual rounded apex. Following the same line of reasoning we may assume that a definitely 3-lobed apex repre-

sents a more recent development than a similarly 2-lobed one. In any case these assumptions make it possible to explain very satisfactorily the inter-relationships of the four known species which clearly represent the highest type of development in the genus *Corynelia*. These species (*C. oreophila, C. brasiliensis, C. portoricensis* and *C. jamaicensis*) are restricted, as far as is known, to the Western Hemisphere, and in all of them the upper portion of the perithecium is marked on the surface by one or more prominent grooves along which dehiscence takes place. They constitute a definite group of closely related species, and it is of interest to speculate concerning the character of the parent stock from which they arose. Here as in the more primitive species of *Corynelia* the asci were doubtless 8-spored. The perithecium was usually 2-lobed at the apex but occasionally a 3-lobed individual occurred. There was also the tendency for asci to occasionally bear less than eight spores, though this phenomenon was not common or pronounced. From this parent stock along one line *C. oreophila* arose by the increasing tendency toward the occurrence of 3-lobed perithecia. This species as it exists today is characterized by 3-lobed perithecia, though an occasional 2-lobed individual shows the retention of the ancestral character. The asci like those of the parent stock are 8-spored though occasional asci contain a smaller number of spores. From the parent stock along a neighboring line *C. brasiliensis* arose by the development on the perithecium of a wedge-shaped apex. In all other respects this species is like *C. oreophila*. The occasional occurrence on the stroma among the typical perithecia of a few small, poorly developed individuals with 2-lobed and 3-lobed apices exactly like those of *C. oreophila* constitutes reversion to the ancestral condition.

Along a third line *C. portoricensis* and *C. jamaicensis* arose from the parent stock by the increasing tendency for the asci to be few-spored. In *C. portoricensis* the form of the perithecium may be assumed to have changed relatively little. The majority of the perithecia are 2-lobed at the apex; a few are 3-lobed. The asci, however, have changed pronouncedly. The tendency seen in the parent stock for the number of spores in the ascus to de-

crease has been carried here to such an extreme that the asci are typically 3- or 2-spored. Occasionally 1-spored asci occur while less commonly asci with more than three spores are found. In *C. jamaicensis* similar conditions are found in the ascus, the tendency toward a 1-spored ascus being carried slightly farther and asci containing more than three spores being rarer than in *C. portoricensis*. The perithcium in *C. jamaicensis* has however changed also, the tendency in the ancestral stock for 3-parted perithecia to occur having been intensified here until 2-lobed individuals are no longer found. Moreover there is evident the tendency for occasional 4-lobed or even 5-lobed apices to appear, the change in the perithecium thus being even more pronounced than in *C. oreophila*, the species which *C. jamaicensis* most closely resembles externally. A study of the known geographical distribution of these four species is also instructive. The two species in which the 3-spored ascus is typical have been reported only from the West Indies, while the two species with typically 8-spored asci are continental having been found only in South America and Central America. On account of the high specialization both in the ascus and in the perithecium, *C. jamaicensis* is to be regarded as representing the highest point of development in the group.

HOST RELATIONSHIPS

The writer has attempted to determine whether or not the various species of *Corynelia* have become restricted to definite species of *Podocarpus*. The amount of material available for study has, however, been insufficient to warrant definite conclusions. Nevertheless the following facts should be recorded. The writer has studied material from twenty-one different species of *Podocarpus* and in only two cases has a single species been found to serve as a host for more than one species of the Coryneliaceae. Both *Tripospora tripos* and *Corynelia uberata* have been found on *Podocarpus elongata*, while *Corynelia oreophila* and *C. tropica* occur on *P. chilina*. In both of these cases the fungi are however of relatively distant relationship. Closely related species have not been seen on the same host. Moreover

a single species frequently occurs on several species of *Podocarpus*. Four hosts have been noted for *C. oreophila*, four for *C. tropica*, and seven for *C. uberata*. Since the genus *Podocarpus* contains a very large number of species and the writer's material of the Coryneliaceae is doubtless relatively limited, the above facts may, however, be found to explain themselves on the basis of coincidence.

SYSTEMATIC ACCOUNT

CORYNELIACEAE Saccardo, Syll. Fung. 9: 1073. 1891

Corynelieae Sacc., in Berlese et Voglino, Additamenta Sylloge Fungorum, p. 193. 1886.

Fungi typically parasitic (two little-known species, *Caliciopsis subcorticalis* and *C. calicioides,* described as saprophytic); stromata formed beneath the epidermis of the host from internal mycelium, later erumpent, black, coriaceous to carbonaceous, sharply demarcated, plane to pulvinate, usually small and scattered, rarely confluent; perithecia seated on the stroma or slightly buried in it, usually cespitose, black, elongated (flask-shaped, barrel-shaped, clavate, top-shaped, etc.), sessile or stipitate; apex either rounded and undifferentiated or variously sulcate and lobed, in some cases flattened into a broad disc, never possessing a typical ostiolum, at maturity dehiscent by a definite, wide opening resulting either from the formation of one or more clefts or by fimbriate-laceration; asci broadly ovate, very long-stipitate, thin-walled, evanescent, 1–8-spored, aparaphysate; ascospores spherical to oval or in one species stellate; asexual spores, unicellular, elongated to allantoid, hyaline to slightly yellowish, borne in pycnidia which usualy accompany the perithecia on the stroma.

KEY TO GENERA

A. Ascospores spherical to oval.
  1. Perithecium definitely stalked.
    a. Perithecium not undergoing proliferation to form a second perithecium at the apex of the first.................. 1. *Caliciopsis.*
    b. Perithecium proliferating........................ 2. *Sorica.*
  2. Perithecium not definitely stalked...................... 4. *Corynelia.*
B. Ascospores stellate.. 3. *Tripospora.*

1. CALICIOPSIS Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. 33: 32. 1880

Hypsotheca Ellis and Everhart, Jour. Mycol. 1: 128. 1885.

Type species, *Caliciopsis pinea* Peck.

Stromata pulvinate, rounded to elongated, scattered or arranged in rather definite rows, occasionally confluent, formed within the host tissue but soon erumpent, bearing a cespitose cluster of perithecia and pycnidia; perithecium black, coriaceous to carbonaceous, stalked, not proliferating; the ascigerous swelling terminal to a sub-median but not basal, when sub-apical then terminated by a tapering beak, urceolate to sub-cylindrical; apex of perithecium at first closed, later a definite opening formed by fimbriate-laceration; asci ovate to clavate, long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores varying from ellipsoidal or sub-fusiform to globose, crowded, smooth, brown, unicellular, thin-walled; pycnidia borne on the stroma with the perithecia, cespitose, sessile, globose to sub-globose, black, papillate, apically ostiolate; pycnospores hyaline or in mass slightly yellowish, minute, unicellular, allantoid.

This genus is very cosely related to *Sorica*. Dehiscence of the perithecium takes place in exactly the same manner in the two genera, and perithecia, pycnidia, asci, and spores are very similar in the two cases. The presence in *Sorica* of the phenomenon of perithecial proliferation is the only essential difference.

Peck (37) founded the genus on *C. pinea*, and states that the species is a discomycete and should be placed near *Cenangium*. He points out that, although in external appearance it resembles certain species of *Calicium*, it is wholly destitute of a thalline crust and gonidial cells, and must be regarded as one of the true fungi.

Ellis (10) in founding *Hypsotheca* states that the genus is clearly closely related to *Caliciopsis*, but, apparently influenced by Peck's statement that *Caliciopsis* is a discomycete, he fails to include it in North American Pyrenomycetes (Ellis 11). He places *Hypsotheca* in the Ceratostomeae on account of the beaked nature of the perithecium, and includes three species, *H. calicioides*, *H. subcorticalis*, and *H. thujina*.

Rehm (41) recognizes the identity of *Hypsotheca* and *Cali-*

ciopsis, and adopts the latter name for the genus. He incorporates it in the Calicieae treating this group as a subdivision of the Patellariaceae of the true discomycetes. He states that while it is apparently true that the majority of the Calicieae possess a more or less well developed lichen thallus, in certain species this has not been demonstrated and seems to be absent. These latter species, therefore, are treated as a group of the true fungi. Seven genera, *Calicium, Caliciopsis, Coniocybe, Sphinctrina, Cyphelium, Acolium*, and *Stenocybe* are included by him in the true discomycetes. It is evident that he is in error in incorporating *Caliciopsis* among these forms. Although the stipitate character of the fruit-body furnishes a point of similarity between *Caliciopsis, Calicium, Stenocybe, Cyphelium*, and *Coniocybe*, there exist important points of difference. The fruit-body of *Caliciopsis* is very certainly a perithecium, while in at least some of the other genera described by Rehm, it is just as surely an apothecium. The examination of Rehm's figures, and of such material as has been available, leads the writer to believe that with the exception of *Caliciopsis*, the other genera included here by Rehm are as stated by him, discomycetous in character. Certainly in the light of our present knowledge there is no reason for regarding them as closely related to the Coryneliaceae.

KEY TO THE SPECIES OF CALICIOPSIS

A. Ascigerous cavity sub-apical, median or sub-median; perithecium beaked; species described as saprophytic on wood of deciduous trees.
  1. Ascospores 6–10 × 3.5–5 μ; perithecium stout and short-stalked. 1. *C. calicioides* (Figs. 35, 36, 47)
  2. Ascospores 4–5 × 3–4 μ; perithecium slender and long-stalked. 2. *C. subcorticalis* (Figs. 37, 38)

B. Ascigerous cavity terminal; perithecium not beaked; species occurring on conifers; ascospores 3.5–6 × 2–4 μ.....3. *C. pinea* (Figs. 33, 34, 48)

1. **Caliciopsis calicioides** (Fries) comb. nov.

? *Sporocybe calicioides* Fries, Syst. Mycol. 3: 340, 342. 1832.
Hypsotheca calicioides E. & E., Jour. Mycol. 1: 129. 1885.
Caliciopsis Ellisii Saccardo, Sylloge Fungorum, 8: 833, 834. 1889.
Hypsotheca caliciodes (Fr.) var. *caespitosa* Ellis in MS.

TYPE: Material labeled *Hypsotheca calicioides* E. & E. in the herbarium of Ellis at the N. Y. Bot. Gard. (collected by Suksdorf in Washington, and sent to Ellis by Sprague).

(Figures 35, 36, 47)

Mycelium in the cortical tissue of poplar, apparently saprophytic; stromata 500–1700 μ in diameter, more or less circular to elongated, scattered or developing in rather definite lines, which appear as concentric circles a few millimeters apart, adjacent stromata occasionally confluent; pycnidia and perithecia borne frequently on the same stroma, cespitose; perithecium shiny to dull, when young glabrous, in age becoming definitely roughened especially over the surface of the ascigerous swelling, 1400–1800 μ long, coriaceous, becoming brittle in age or on drying, consisting of a stalk, a median or sub-median enlargement containing the ascigerous cavity and a terminal beak; the enlargement sub-cylindrical-vesiculose, 270–480 μ long and measuring in lateral diameter at the middle 200–340 μ, not observed to collapse laterally as in the other species of the genus; the stalk 100–170 μ in diameter, relatively shorter and more rigid than in the other species, somewhat broadened at the base; beak at the beginning merely a short conical continuation of the ascigerous enlargement,[1] later more elongated, rigid and straight or sometimes curved, reaching in some cases 1 mm. in length, narrower than the stalk, 75–125 μ in diameter; the apex in the beginning sharp-pointed and closed, sometimes possessing a minute umbilicus which resembles superficially an ostiolum, at maturity becoming fimbriate-lacerate, the hyphal elements spreading apart and forming a broad, reddish-brown, fuzzy fringe around a central funnel-shaped opening; asci ovate to clavate, 15–20 $\times$ 8–11 μ; spores sub-fusiform to ellipsoidal to oval, 6–10 $\times$ 3.5–5 μ (aver. 7 $\times$ 3.5 μ); pycnidia 140 μ in diam.; pycnospores 2.5–3 μ long, hyaline or in mass slightly yellowish.

Ellis (10, 11) based his published descriptions of this species chiefly on the material collected by Suksdorf in Washington on poplar. He saw also, however, the material distributed by Ravenel,[2] and regarded the two collections as identical. The writer has examined material of both of these collections and also of an additional collection in the herbarium of Ellis labeled by him *Hypsotheca calicioides* (Fr.) var. *caespitosa* n. var.

[1] A double ascigerous enlargement forked at the upper end and bearing two beaks was present in one case as an interesting abnormality.

[2] Fungi Caroliniani I: 83.

This last collection was made in 1891, but Ellis makes no reference to it in North American Pyrenomycetes or in subsequent papers. In this material the stromata are broader than in the Suksdorf collection and the perithecia of a single cluster are consequently more numerous. The cespitose habit is present in both cases though in the Suksdorf material a single perithecium may sometimes occur alone on a small stroma. It is probable that the Suksdorf material is somewhat younger, especially since the ascospores are slightly smaller and lighter colored. In the material distributed by Ravenel the perithecia seem somewhat more slender than in the Suksdorf collection. The relatively small number of collections of material available for study renders these minor differences especially noticeable and in the present state of our knowledge there seems to be no better course than to incorporate the known material under the one species.

The species differs from *C. subcorticalis* especially in its stouter, more rigid perithecia and in its larger ascospores.

Ellis obtained the specific name for this species from the older binomial, *Sporocybe calicioides* Fries (13) which he cites as a synonym. The description published by Fries is, however, clearly based on a hyphomycetous fungus, and there seems to be no reason for assuming the two fungi to be the same. The original material of Fries is, according to Juel, not now present in the herbarium at Upsala, and has probably been lost. Since Ravenel[2] distributed material of the fungus of Ellis under the name *Sporocybe calicioides* Fries, this name is cited in the synonomy above with an interrogation mark.

MATERIAL EXAMINED

Ravenel's Fungi Caroliniani 1: 83 (specimen in herbarium Harvard Univ.); specimen collected by Suksdorf (No. 256) in Washington territory and sent to Ellis by C. G. Sprague, Dec., 1883. (Ellis Herb. N. Y. Bot. Gard.); specimen in Ellis' herbarium labeled in his handwriting *Hypsotheca calicioides* (Fr.) var. *caespitosa* n. var. (No. 71, March, 1891, on decaying poplar log).

2. **Caliciopsis subcorticalis** (Cooke & Ellis) comb. nov.

Sphaeronema subcorticale Cook & Ellis, Grev. **6**: 83. 1878.

Calicium ephemerum Zwackh, Lichenen Heidelbergs p. 81, 1883.

Hypsotheca subcorticalis (Cooke & Ellis) Ellis & Everhart, Jour. Mycol. **1**: 129. 1885.

Hypsotheca ephemera (Zwackh) Sacc., Syll. Fung. **10**: 72. 1891.

Caliciopsis ephemera (Zwackh) Rehm, Rabenhorst Kryptogamen Flora 1^3: 388. 1896.

ILLUSTRATIONS: E. & E. North American Pyrenomycetes *pl. 22. figs. 1–5.*

TYPE: Herb. Cooke, No. 2743, Royal Botanic Gardens, Kew. Portion of this deposited in Fitzpatrick herbarium as No. 1738

(Figures 37, 38)

Mycelium apparently saprophytic in the cortical tissue of oak; stromata small, approximately 0.3 mm. in diameter, scattered, usually hidden in the crevices of the bark, bearing a cespitose cluster of pycnidia and perithecia, the perithecia protruding at maturity from the crevices in the bark as minute, slender, black spines; perithecium glabrous, dull to shiny, reaching 1.5 mm. in length, when young probably coriaceous and white within, in age or in dried specimens becoming brittle and easily broken away, consisting of a long stalk, a median or sub-apical enlargement containing the ascigerous cavity,[3] and a terminal beak; the enlargement sub-cylindrical-vesiculose, 200–325 μ long and reaching 150 μ in lateral diameter at the middle, sometimes laterally collapsed as in *C. pinea* but not inclined to one side as frequently happens in that species; the stalk long, slender, 80–125 μ in diam., cylindrical, straight to flexuous, swollen at the point of attachment to the stroma; beak of approximately the same diameter as the stalk, occasionally attenuated toward the tip especially when young, in some perithecia exceeding 500 μ in length, traversed by a narrow canal; the apex in immature stages sharp-pointed, closed, at maturity becoming minutely fimbriate-lacerate, and having a reddish-brown, fuzzy appearance, finally dehiscent, the terminal hairs spreading apart and forming a fringe around a definite opening; asci ovate to clavate, $12–15 \times 7–9\,\mu$ (p. sp.), spores ellipsoidal to oval or globose, $3–4 \times 4–5\,\mu$; pycnidia approximately 100 μ broad; pycnospores 2.5–3.5 μ long.

[3] In the specimen of E. & E. N. A. F. 2nd series No. 2123 in Professor Thaxter's herbarium at Harvard University one abnormal and unusually long perithecial stalk was observed which had developed a half-dozen lateral buds, apparently containing ascigerous cavities.

Found by Ellis at Newfield, N. J., on loosened pieces of bark, on dry, decaying oak limbs lying on the ground. Reported by Rehm (41) from Heidelberg, Germany, on the young, lower branches of oak. Only the American material has been examined by the writer. In the present state of our knowledge there is no reason to assume that the species is parasitic. The material distributed by Ellis[4] bears on the label of the packet the statement that the fungus is parasitic on old *Dichaena strumosa* Fr. on *Quercus coccinea*. An examination of the specimen leads the writer to feel that the presence of the *Dichaena* on the bark is merely incidental, and that there is no reason for assuming that the *Caliciopsis* is parasitic on it. The label accompanying the type material makes no reference to a parasitic condition or to *Dichaena*. Moreover Ellis makes no such reference in the published descriptions of the species (9, 10, 11). Only a very small amount of material has been available for examination, and the writer has not seen the species in nature. In as far as he is aware only the two collections made by Ellis at Newfield, N. J., in 1877 and 1883, are known for America.

Rehm (41) discusses this species under the name *Caliciopsis ephemera* (Zwackh) Rehm, though stating that he examined North American material[4] of *Hypsotheca subcorticalis* and found it to be identical with *Calicium ephemerum* Zwackh.[5] Since the description of *Sphaeronema subcorticale* C. & E. antedates that of Zwackh (57) by five years, it is clear that the specific name applied by Zwackh cannot be maintained. Rehm, however, states that Zwackh in his description of *Calicium ephemerum* cites *Stilbum rugosum* Fries and *Coniocybe Beckhausii* Körber (26) as synonyms. The papers of Zwackh and Körber are both unavailable to the writer, but according to Rehm, Körber failed to find asci in *Coniocybe Beckhausii*. A citation of the place of publication of *Stilbum rugosum* Fries is not given by Zwackh (57), Rehm (41), or Saccardo (45), and apparently an error has occurred in the publication of this name. Professor O. Juel states in a letter to the writer that no specimen bearing this

[4] E. & E. N. A. F. 2nd series No. 2123.

[5] Lichenes exsiccati No. 477.

name exists in the herbarium at Upsala, and that a careful search fails to disclose the use of the name in any of the writings of Fries. In the present state of our knowledge neither *Stilbum rugosum* Fries nor *Coniocybe Beckhausii* Körber can logically be included in the synonomy of the species here described. Although the writer has not seen a specimen of the material of *Calicium ephemerum* distributed by Zwackh,[5] the name is included above in the synonymy because Rehm has seen this material and has pronounced it identical with the American specimens distributed by Ellis.

MATERIAL EXAMINED

Herb. Cooke, No. 2743 (*type* collection of *Sphaeronema subcorticale* C. & E., Royal Botanic Gardens Kew; fragment of this preserved as Fitzpatrick Herb. No. 1738); Ellis and Everhart, N. Am. Fungi, 2nd series, No. 2123 (Underwood Collection at N. Y. Bot. Gard.; also in Herb. R. Thaxter at Harvard Univ.).

3. CALICIOPSIS PINEA Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. 33: 32. *pl. 2. figs. 11–15.* 1880, and in Bull. Torr. Bot. Club 9: 62. *pl. 24. figs. 8–12.* 1882

Calicium stenocyboides Nylander, Flora 65: 451. 1882.
Cyphelium stenocyboides (Nylander) Arnold, Lichenes Monacenses Exsiccati, No. 417, 1895.
Caliciopsis stenocyboides (Nylander) Rehm, in Rabenhorst Kryptogamen Flora 1^3: 389. *figs. 1–4.* 1896.

ILLUSTRATIONS: Peck, Ann. Rept. N. Y. State Mus. Nat. Hist. 33: *pl. 2. figs. 11–15;* Bull. Torr. Bot. Club 9: *pl. 24. figs. 8–12;* Rev. Mycol. 4: *pl. 29. fig. 7;* Rehm in Rabenhorst Kryptogamen Flora 1^3: 383. *figs. 1–4.*

TYPE: In the herbarium of Peck at Albany, N. Y. Material of original collection also in herbarium at New York Botanical Garden. Both specimens studied by writer, and permanent slides showing mature asci, ascospores, and pycnospores deposited in his herbarium as No. 1688.

(Figures 33, 34, 48)

Mycelium parasitic[6] in the trunk and branches of pine, causing the formation of sharply delimited, depressed areas (cankers) in the cortical tissue; these cankers frequently several inches in diameter and characterized by a smoother surface and more reddish color than the surrounding bark; stromata numerous, more or less definitely circular, scattered over the canker, several occasionally confluent, minute, scarcely visible, each entirely covered with a cespitose cluster of pycnidia and perithecia, 0.5–1.0 mm. in diameter, occasionally smaller bearing only one or two fruit-bodies; pycnidia usually preceding the perithecia, but both often found on the same stroma; perithecia appearing to the naked eye as fascicles of black spines arising from the surface of the bark; perithecium glabrous, dull to shiny, reaching 2 mm. in height, when young white within and coriaceous, in age or in dried specimens becoming brittle and easily broken off, long-stipitate, the ascigerous cavity developed within a terminal urceolate swelling which at maturity is frequently laterally collapsed, and curved or inclined to one side, resembling strikingly the capsule in certain mosses (genus *Hypnum*); occasionally the apex of the stalk forked and bearing two or even three terminal ascigerous swellings; the stalk long, reaching 1600 μ, slender, 100–140 μ in diam., cylindrical, either straight or definitely curved to one side, not flexuous, swollen at the base; the perithecium reaching almost its full length before the terminal ascigerous swelling is formed, and in immature stages appearing as a sharp-pointed spine of uniform diameter; the terminal enlargement at first clavate, 400 μ long $\times$ 175–275 μ wide, closed; at maturity the apex of the swelling becoming fimbriate-lacerate and assuming the reddish-brown, fuzzy appearance seen in several other members of the family, finally dehiscent, the terminal tuft of hairs spreading apart and forming a fringe around a definite opening; asci ovate, 12–17 $\times$ 5–8 μ (p. sp.), spores ellipsoidal to ovoidal or globose, 3.5–6 $\times$ 2–4 μ; pycnidia 100–150 μ; pycnospores 2.5–3.5 μ long.

Parasitic[6] on *Pinus strobus* in eastern North America. Found on *P. rigida* in New Jersey by Ellis, and reported from Germany by Rehm (**41**) on *Pinus pumilo* and on fir. The material on *Pinus pumilo* distributed by Arnold[7] under the name *Cyphelium stenocyboides* has been examined by the writer and is

[6] The statement that the species is parasitic is based wholly on field observations on *Pinus strobus*, and is not yet supported by artificial infection experiments.

[7] No. 417 Lichenes Monacensis exsiccati.

identical with American material of *Caliciopsis pinea*. No material on fir has been seen by the writer, but Rehm reports its collection on this host at Heidelberg. One of the specimens[8] cited by Rehm (41) has been unavailable to the writer and probably contains the material collected on fir.

MATERIAL EXAMINED

New York: *type* material collected at Charlton by Chas. Peck (in Peck Herb. Albany, N. Y.; also in Herb. N. Y. Bot. Gard.); Fitzpatrick Herb. Nos. 1664, 1665, 1669, 1726, and 1739 (material collected at various points near Ithaca).

New Jersey: Herb. C. E. Fairman No. 2004 (material collected Apr. 1889 at Newfield by Ellis on *Pinus rigida;* other material of same collection in Ellis Herb. at N. Y. Bot.); another specimen in Ellis Herb. collected by him at Newfield, Dec. 12, 1881, probably also on *Pinus rigida.*

Massachusetts: Material collected at Manchester by W. C. Sturgis, Oct. 1888 (Herb. C. E. Fairman No. 2002, and three packets at N. Y. Bot. Gard. labeled "ex. Herb. Seymour"); material collected by Sturgis at Manchester, Nov. 1888 (two packets at N. Y. Bot. Gard. labeled "ex. Herb. W. G. Farlow"); material collected by Sturgis at Manchester, Dec. 8, 1888 (E. & E. N. Am. Fungi No. 2382 in Herb. C. E. Fairman, and at N. Y. Bot. Gard.).

Pennsylvania: Herb. Fitzpatrick No. 1792 (material collected at Stone Valley, June 12, 1920).

Vermont: Herb. C. G. Pringle No. 300 (in Herb. W. G. Farlow at Harvard Univ., in Peck Herb. Albany, N. Y., and Fitzpatrick Herb. No. 1741). Material collected by Pringle at Charlotte.

Germany: Arnold, Lich. Monoc. Exsic. No. 417 (in Herb. Harvard Univ.) on *Pinus pumilo.*

2. SORCIA Giesenhagen, Ber. Deut. Bot. Gesell. **22:** 191–196. *pl. 13.* 1904

Capnodiella Saccardo, Syll. Fung. **17:** 621. 1905 (Syll. Fung. **1**: 74. 1882, as subgenus).

8 v. Zwackh-Holzhausen, Lichenes exsiccati No. 686.

Type species, *Capnodium maximum* Berk. & Curt.

Stromata, black or dark-brown, formed within the living leaves of the host, later erumpent, bearing pycnidia and perithecia; perithecium black, coriaceous, very long-stalked, the ascigerous portion clavate, tapering into a long, beak-like neck traversed by a canal; apex at first closed but at maturity fimbriate-lacerate, a definite opening finally resulting; proliferation of the perithecium taking place after the escape of the ascospores, the stalk of a second perithecium arising as a continuation of the beak-like neck of the first and emerging from the opening at the tip of the beak; the second perithecium long-stalked and in every way identical with the first; by the repetition of this phenomenon as many as five perithecia formed in linear series; two perithecia occasionally arising from one opening, a definite fork thus being formed; asci ovate, very long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores spherical to sub-ellipsoidal, thin-walled, brown, unicellular; pycnidia borne on the stroma among the perithecia, sessile or short-stipitate, globose, black; pycnospores hyaline, fusiform, unicellular.

Resembling *Caliciopsis* in asci, ascospores, pycnidia, and pycnospores, and differing from that genus essentially only in the possession of the phenomenon of proliferation. The method of dehiscence of the perithecium is identical with that found in *Caliciopsis, Tripospora tripos,* and *Corynelia fructicola*.

The subgenus *Capnodiella* of the genus *Capnodium* Montagne was erected by Saccardo (45) to include the single species *Capnodium maximum* Berk. & Curt., which differs from other members of the genus in having unicellular ascospores. Later the subgenus, still containing the single species, was raised by him (Saccardo 45) to generic rank. Meanwhile Giesenhagen (15) studied material of the same fungus, and failing to recognize it as *Capnodium maximum,* founded the genus *Sorica* upon it. He named the species *S. Dusenii* but later (16) having learned of his error, changed the name to *S. maxima* (Berk. & Curt.) Giesenhagen. The genus *Sorica* is placed by him in the Sphaeriaceae-Phaeosporeae of Saccardo, though he regards it as of doubtful relationships. He suggests the possibility of including it in the Xylariaceae or in the Ceratostomataceae. Von

Höhnel (21) includes *Capnodiella* in his enumeration of the genera of the Capnodiaceae, but subsequently (22) states that the genus is in reality a member of the Coryneliaceae. He feels that it is closely related to *Corynelia*, differing from that genus chiefly in the long stalk of the perithecium. Finally Stevens (49) describes the fungus as new under the name *Corynelia pteridicola Stevens.* The writer has examined several collections of this fungus, and agrees with von Höhnel and Stevens that the species should be included in the Coryneliaceae, but he feels that it differs sufficiently from all the known species of *Corynelia* to warrant its exclusion from this genus. The genus *Sorica* is therefore recognized for it. Patouillard and Gaillard (35) state that the species is closely related to *Capnodium arrhizum* Pat. & Gail., a fungus found by Gaillard in Venezuela on dead leaves lying on the ground. All the material of the original collection of this latter species was deposited in the herbarium of Gaillard, the collector. Patouillard has written to the writer stating that he has never had material of the species in his own herbarium, and that he does not know what became of the herbarium of Gaillard after the latter's death. The original material of *Capnodium arrhizum* must be considered, therefore, as unavailable if not actually lost. A study of the figures and description given by the authors of the species, has convinced the writer, however, that this fungus is very different from *Sorica maxima*, and clearly not a member of the Coryneliaceae.

1. SORICA MAXIMA (Berk. & Curt.) Giesenhagen, Ber. Deut. Bot. Gesell. **22**: 355–358. 1904

Capnodium maximum Berk. & Curt., Jour. Linn. Soc. Bot. **10**: 391. 1869.

Sorica Dusenii Giesenhagen, Ber. Deut. Bot. Gesell. **22**: 191–196. *pl. 13*. 1904.

Capnodiella maxima (Berk. & Curt.) Saccardo, Syll. Fung. **17**: 621. 1905.

Corynelia pteridicola Stevens, Illinois Acad. Sci. Trans. **10**: 179–181. *fig. 6*. 1917.

ILLUSTRATIONS: Giesenhagen, Ber. Deut. Bot. Gesell. **22**: *pl. 13.* 1904; Stevens, Ill. Acad. Sci. Trans. **10**; *fig. 6.* 1917.

TYPE: in the herbarium of Berkeley, at the Royal Botanic Gardens, Kew, England; co-type material in the herbarium of Curtis at Harvard University. Both of these have been examined by the writer, and a portion of the type is deposited in his herbarium.

(Figures 30–32, 49)

Mycelium parasitic in the leaves of the host, localized, confined to a small area surrounding the point of infection, forming a definite stroma within the host tissue; stromata in some collections of material scattered irregularly over the leaf, in others confined to the sori, the general appearance of the fungus on the host in the two cases consequently very different; the stroma when formed in the sorus not well-developed, buried from sight below the mass of host sporangia, not spreading to the other host tissues, usually not forming a spot in the leaf, and never observed to result in its perforation; perithecia arising as black bristles among the host sporangia and radiating in every direction; stromata when formed in other portions of the leaf erumpent, usually hypophyllous, at first minute, gradually increasing in area, the central portion soon falling out, leaving only the opposite epidermis or more often a complete perforation; the hole thus formed in the leaf reaching 3–4 mm. in diameter, surrounded by an annular or ring-shaped stroma, less than 1 mm. in width, and of the thickness of the leaf or slightly thicker; stromata from the first bearing numerous pycnidia and perithecia; later when the hole appears in the leaf the perithecia forming a ring of bristles around the perforation and arising from the annular stroma on both the upper and lower surfaces; perithecium shiny to dull, 1–1.5 mm. long, stalk 35–50 μ thick, the ascigerous portion glabrous, 125–150 μ in diam. $\times$ 250 μ in length, tapering into a glabrous beak-like neck, 200–350 μ long; stalk frequently hairy with brown hyphae; asci 15–17 $\times$ 10 μ (p. sp.), ascospores 5–6 $\times$ 4–5 μ; pycnidia covered with brown hairs like those on the stalk of the perithecium; pycnospores 11–24 $\times$ 4 μ.

Parasitic on *Polypodium* (*Campyloneurum*) *phyllitidis, P. punctatum, P. crassifolium, P. Schomburghianum* and probably other species in Cuba, Porto Rico, San Domingo, Brazil, Ecuador, Venezuela, and probably other neighboring countries.

Giesenhagen (**15**) states that the brown hairs which clothe the pycnidium and the stalk of the perithecium are conidial bearing

and he figures a cluster of very minute conidia at the tip of one of these hairs. His observations have not been corroborated by the writer.

Seven specimens of this fungus have been examined by the writer. In five of these the fungus occurs exclusively in the sori; in the other two, sori are absent and the stromata are scattered irregularly over the leaf. The general appearance of the fungus in the two cases is different, but the perithecia, asci, and spores are identical. Giesenhagen saw both forms of this species and suggests that the fungus more often occurs in the sorus because the outer wall of the epidermal cells of this structure in the young condition is thin and permits of easy penetration, while the cuticle covering the other cells offers greater resistance. He states that when the stromata are formed on the leaf outside of the sori they border wounds caused by biting insects. The observations of the writer and those of Stevens show that the holes in the leaf are caused by the advance of the fungus rather than by the biting of insects, and infection apparently occurs on the uninjured epidermis. The condition or age of the host at the time of infection probably determines the type of tissue attacked. It seems best in the present state of our knowledge to regard all the material as representing one species. It is of interest to record that the type material of Berkeley shows the fungus in the sori, while the original specimens upon which Stevens based his description of *Corynelia pteridicola* show the annular stromata scattreed over the leaf surface.

MATERIAL EXAMINED

Porto Rico: Herbarium University of Illinois, Porto Rican Fungi No. 3551 (material cited by F. L. Stevens as the *type* of *Corynelia pteridicola;* communicated by him).

San Domingo: Herbarium of the Experiment Station of the Board of Commissioners of Agriculture, Rio Piedras, Porto Rico, No. 1021a (material collected April 7, 1913 by J. R. Johnston at La Romana, communicated by J. A. Stevenson, and deposited as Fitzpatrick Herb. No. 1528).

Cuba: Fungi Cubenses Wrightiani No. 786 (*type* material of *Capnodium maximum* B. & C. from the herbarium of Berkeley

Kew, England; also *co-type* material from the herbarium of Curtis at Harvard University).

Brazil: Rehm, Ascomycetes No. 1817 (in herb. New York Bot. Gard.; also in herb. C. E. Fairman). See Ann. Mycol. **7**: 138. 1909.

Ecuador: Herbarium of Patouillard (collected by Sodiro at Puente de Chimbo; communicated by Patouillard).

3. TRIPOSPORA Saccardo, in Berlese et Voglino, Additamenta Syll. Fung. p. 194. 1886

Type species, *Corynelia tripos* Cooke.

Stromata black, pulvinate, amphigenous and caulicolous, rounded to elongated, formed within the host tissue, later erumpent, not irregularly scattered, arranged definitely in rows and becoming confluent, bearing compact clusters of perithecia; perithecium flask-shaped with a globose to ovoidal ascigerous portion seated on the stroma and a long, cylindrical neck, which in the young condition is rounded at the apex and closed; at maturity the apex of the neck flattening into a disc which becomes fimbriate-lacerate; finally the margin of the disc recurving to give a wide funnel-shaped opening; asci as in *Corynelia,* ovate, long-stalked, thin-walled, evanescent, 8-spored, aparaphysate; ascospores very characteristic, star-shaped, consisting of 4 (rarely 5) conical, sharp-pointed projections radiating from a rounded central portion, hyaline when young, becoming dark-brown, at maturity opaque and nearly black, thick-walled, unicellular.

Differing from *Corynelia* chiefly in the shape of the spores. The general appearance of the perithecium is very similar to that of *Corynelia fructicola.*

1. TRIPOSPORA TRIPOS (Cooke) Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien 1^1: 413. 1897

Corynelia tripos Cooke, Grev. **8**: 34. 1879.

Tripospora Cookei (Cooke) Saccardo, in Berlese et Voglino, Additamenta Sylloge Fungorum, p. 194. 1886.

ILLUSTRATIONS: Winter, Ber. Deut. Bot. Gesell. **2**: figs. *1–3;* Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien 1^1: *figs. 261 f. h. j.*

TYPE: in herbarium of Cooke at Kew, England, Miss E. M. Wakefield has compared the type with the specimen of No. 3150

Rabenhorst-Winter, Fungi europaei at Kew, and states that they are the same, the latter being in fact co-type material. The writer has seen material of this exsiccati number in four different herbaria, and the accompanying photographs and drawings were made from that in the herbarium at Cornell University.

(Figures 22–25, 44, 45)

Stromata bearing a compact cluster of perithecia, 0.5–1.5 $\times$ 0.5 mm., not irregularly scattered, arranged definitely in rows and becoming confluent; these rows reaching sometimes a length of 10 mm. (15–20 mm. acc. Winter **55**), but usually shorter, several rows frequently formed on the surface of one leaf; perithecia occurring on the stroma in a compact cluster of 2 to 16 (usually 4–8, and on isolated stromata radiating toward all sides, so oriented when the stromata form a row that they point to the left and right, the appearance of the fungus thus becoming regular and very beautiful; young perithecium definitely flask-shaped, with a roughened, spherical to ovoidal, ascigerous, basal portion and a long, cylindrical, glabrous, shiny neck which is rounded at the tip and blunt; the neck of the perithecium in early stages provided with a canal and marked at the apex with a minute umbilicus, but closed; in later stages the apex of the beak flattened to form a slightly convex disc, the diameter of which equals that of the ascus-bearing portion of the perithecium; this disc becoming fimbriate-lacerate, and assuming a reddish-brown, fuzzy appearance, finally definitely dehiscent, the margin recurving, exposing the lighter colored inner wall of the neck of the perithecium and resulting in the formation of a broad, funnel-shaped cavity, the center of which is usually filled with a black mass of spores; immature asci, 30–35 $\times$ 40–60 μ (p. sp.), mature asci containing opaque spores not observed; ascospores 22–34 μ in diameter (measured from tip to tip of adjacent projections).

Parasitic on the leaves and green parts of the stem of *Podocarpus elongata* and *P. Thunbergii* in South Africa, and of *P. Lamberti* in Brazil. Not known to the writer on other hosts or from other localities. The species has long been known from South Africa and is not uncommon there. It was collected in Brazil by Ule and recorded by Rehm (**42**). The material from Brazil available for examination differs from the South African material in having a slightly larger, rougher, and longer-necked perithecium. In other respects the two are alike.

Winter states that on account of the opaqueness of the mature ascospores it is not possible to determine whether the conical projections are cut off by septa from the rounded central portion. The writer has seen no indication of the presence of septa, and regards the spores as unicellular at all stages.

Material Examined

Cape Province, S. Africa: Rabenhorst-Winter, Fungi europaei No. 3150 (*co-type:* one specimen in herb. Plant Path. Cornell Univ., two in herb. New York Bot. Gard., one in herb. Rehm, Stockholm, Sweden); Union Department of Agric., Mycological herb. No. 7355 (communicated by Ethel M. Doidge).

Natal, S. Africa: herbarium Fitzpatrick No. 1563 (col. Miss A. V. Duthie, communicated by Doctor van der Bijl of Berea Durban).

Brazil, S. America: herbarium Rehm Nos. 1744 and 1747 (col. Ule at Serra Geral, communicated by L. Romell of Riksmuseum, Stockholm, Sweden; fragment and slides preserved in Fitzpatrick Herb. as No. 1579).

(To be concluded in the September number)

EXPLANATION OF PLATES

Plate 12

Corynelia portoricensis

Fig. 1. Clusters of perithecia on leaves of *Podocarpus coriaceus.* × 2½.

Fig. 2. A cespitose cluster of perithecia arising from a single stroma. Various stages in the dehiscence of the perithecium are shown. × 11.

Fig. 3. Two clusters of mature but unruptured perithecia. Near the center of each cluster a single trilobed individual occurs. × 11.

Plate 13

Fig. 4. *Corynelia brasiliensis.* A stellate cluster of mature but unopened perithecia. The stroma appears at the center of the cluster as a prominent cushion. × 11.

Fig. 5. *C. brasiliensis.* Two coalescent clusters of perithecia. Near the center of each cluster the stroma appears as a prominent cushion. The perithecia show in practically every case the last stage of dehiscence. × 11.

Fig. 6. *C. jamaicensis.* A cluster of unopened perithecia. Although the majority of the perithecia are trilobed, a single quadrilobed individual appears in the lower right hand portion of the figure. × 11.

Fig. 7. *C. jamaicensis.* A cluster of old weathered perithecia. The individuals have all opened, and the 3-pronged apices resulting from the spreading of the lobes show clearly at the center of the figure. × 11.

Fig. 8. *C. oreophila.* A stellate cluster of mature but unopened perithecia. The stroma appears at the center of the cluster as a roughened cushion. × 11.

Fig. 9. *C. oreophila.* A more typical cluster of perithecia. At the center of the group the surface of the stroma appears greatly roughened, due to the fact that new perithecia are beginning to form where others were earlier broken away. None of the perithecia in this cluster are in reality bilobed. Those individuals which appear bilobed have an additional lobe hidden from view. For demonstration of this fact compare this figure with Fig. 12. × 11.

Fig. 10. *C. oreophila.* A small group of perithecia, a single individual of which shows clearly the type of dehiscence characteristic of the species. × 11.

Fig. 11. *C. oreophila.* A stroma bearing seven perithecia, one mature, six immature. The tips of two of the young individuals have been broken away, exposing their white interiors. × 11.

Fig. 12. *C. oreophila.* The same cluster of perithecia shown in Fig. 9 photographed from a different angle. A careful comparison of the two figures will show that none of the perithecia are in reality bilobed. × 11.

PLATE 14

Fig. 13. *Corynelia uberata.* Clusters of perithecia on leaves of *Podocarpus Thunbergii.* × 2½.

Fig. 14. *C. uberata.* Clusters of immature perithecia. The tips of several individuals crushed and broken over in the lower cluster. × 11.

Fig. 15. *C. uberata.* A cluster of almost mature but unruptured perithecia, the apex of each traversed by several deep furrows. Dehiscence occurs later along the line of the middle furrow. × 11.

Fig. 16. *C. uberata.* A similar cluster of perithecia, but with many individuals broken away, exposing their white interiors. × 11.

Fig. 17. *C. uberata.* A small group of perithecia several individuals of which are wholly mature and show clearly the characteristic method of dehiscence by a single deep apical cleft. × 11.

Fig. 18. *C. uberata.* A copy of one of the illustrations published by Acharius in connection with the original description of this species in Observationes Mycologicae of Fries. Compare with Fig. 16. Magnification of original figure not given, but reproduced here as published.

Fig. 19. *C. nipponensis.* A cluster of mature but unruptured perithecia. Ruptured perithecia have not yet been seen but the presence of a single definite transverse furrow at the apex in many individuals indicates a type of dehiscence similar to that in *C. uberata.* × 11.

PLATE 15

Fig. 20. *Corynelia fructicola.* Numerous perithecia arising from stromata on the surface of a fruit of *Rapanea melanophloeos.* The stromata stand close together and tend to form a crust which frequently covers the whole sur-

face of the fruit. In this case the portion of the fruit most densely covered with stromata is equatorial. Many of the perithecia here visible at the periphery have the fuzzy terminal disc indicative of maturity. Compare with the same stage in *Tripospora tripos* shown in Figs. 23 and 25. × 11.

Fig. 21. *C. fructicola.* Same as Fig. 20 but showing clearly a cluster of immature perithecia at the top of the figure. In these the terminal disc has not yet been formed. × 11.

Fig. 22. *Tripospora tripos.* Clusters of immature perithecia on both surfaces of the leaf of *Podocarpus elongata.* The stroma shows clearly at the center of each cluster. × 11.

Fig. 23. *T. tripos.* Cluster of mature perithecia showing the fuzzy terminal discs indicative of maturity. Compare with same stage in *Corynelia fructicola* in Fig. 20. × 11.

Fig. 24. *T. tripos.* Mature and dehiscent perithecia. The apex of the perithecium appears as a funnel with a fuzzy brown margin and a throat filled with a black powder consisting of the spores. × 11.

Fig. 25. *T. tripos.* A few perithecia of the same age as those pictured in Fig. 23 shown in lateral view. × 11.

PLATE 16

Fig. 26. *Corynelia tropica.* A group of mature but unruptured perithecia. Material collected in Chile. × 11.

Fig. 27. *C. tropica.* A more elongated group of perithecia. Material a portion of the type collection (No. 1261.' Rabenhorst, Fungi europaei) from Chili. × 11.

Fig. 28. *C. tropica.* A cluster of mature ruptured perithecia. The type of dehiscence is similar to that in other species in which a single apical cleft occurs, but here the resultant lobes have the fuzzy character of the disc in *Tripospora tripos.* Material collected in Chili. × 11.

Fig. 29. *C. tropica.* Clusters of immature perithecia from a collection of material made in the Philippine Islands. × 11.

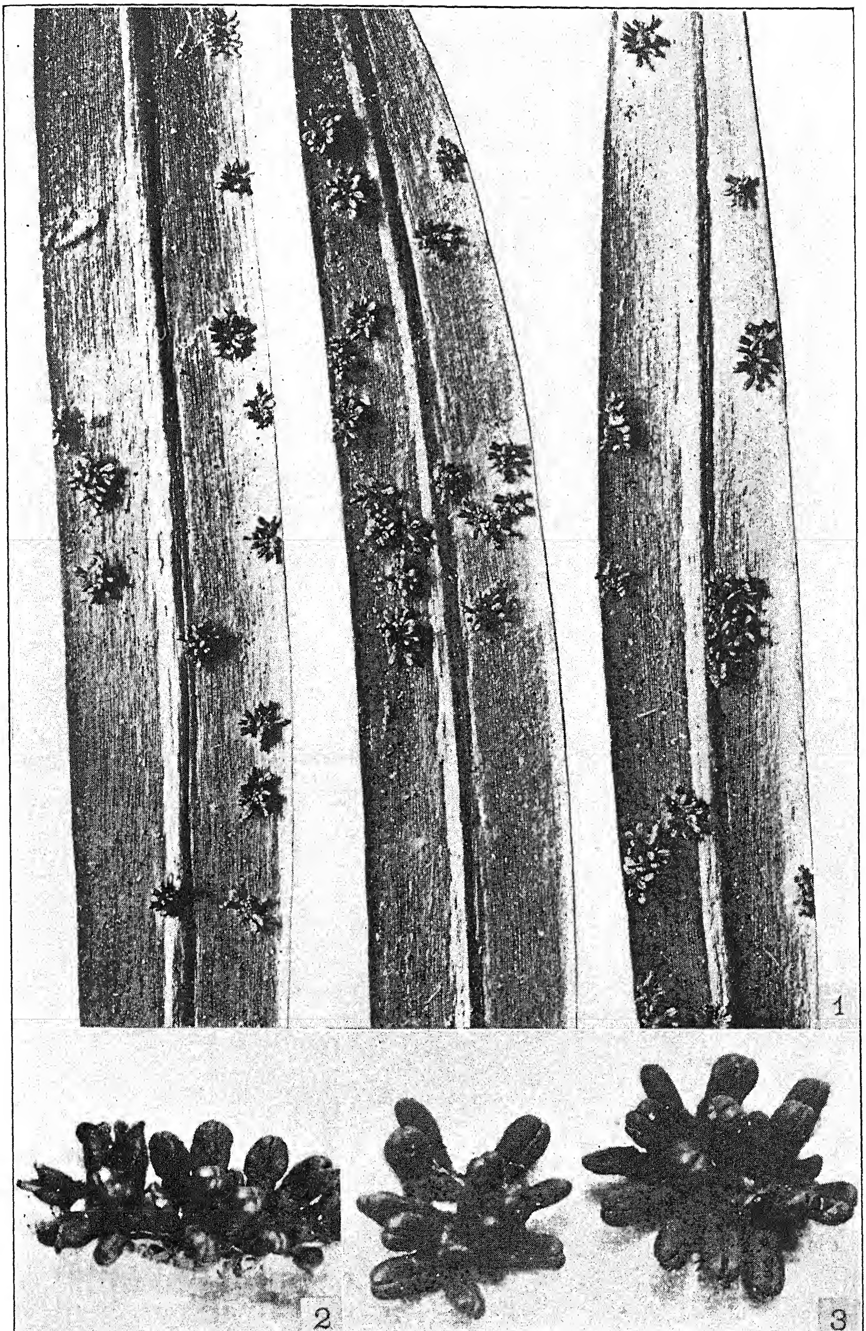
Fig. 30. *Sorica maxima.* Perithecia arising from an annular stroma bordering a perforation in the frond of *Polypodium.* As a result of proliferation several perithecia may be seen in linear series. Material photographed is a portion of the original collection on which Stevens founded *Corynelia pteridicola.* × 11.

Fig. 31. *S. maxima.* Perithecia arising from a stroma at the base of a sorus of sporangia on the leaf of *Polypodium.* These are the primary perithecia and proliferation has not yet taken place. Material photographed distributed by Rehm (Ascomyceten No. 1817) as *Capnodiella maxima.* × 11.

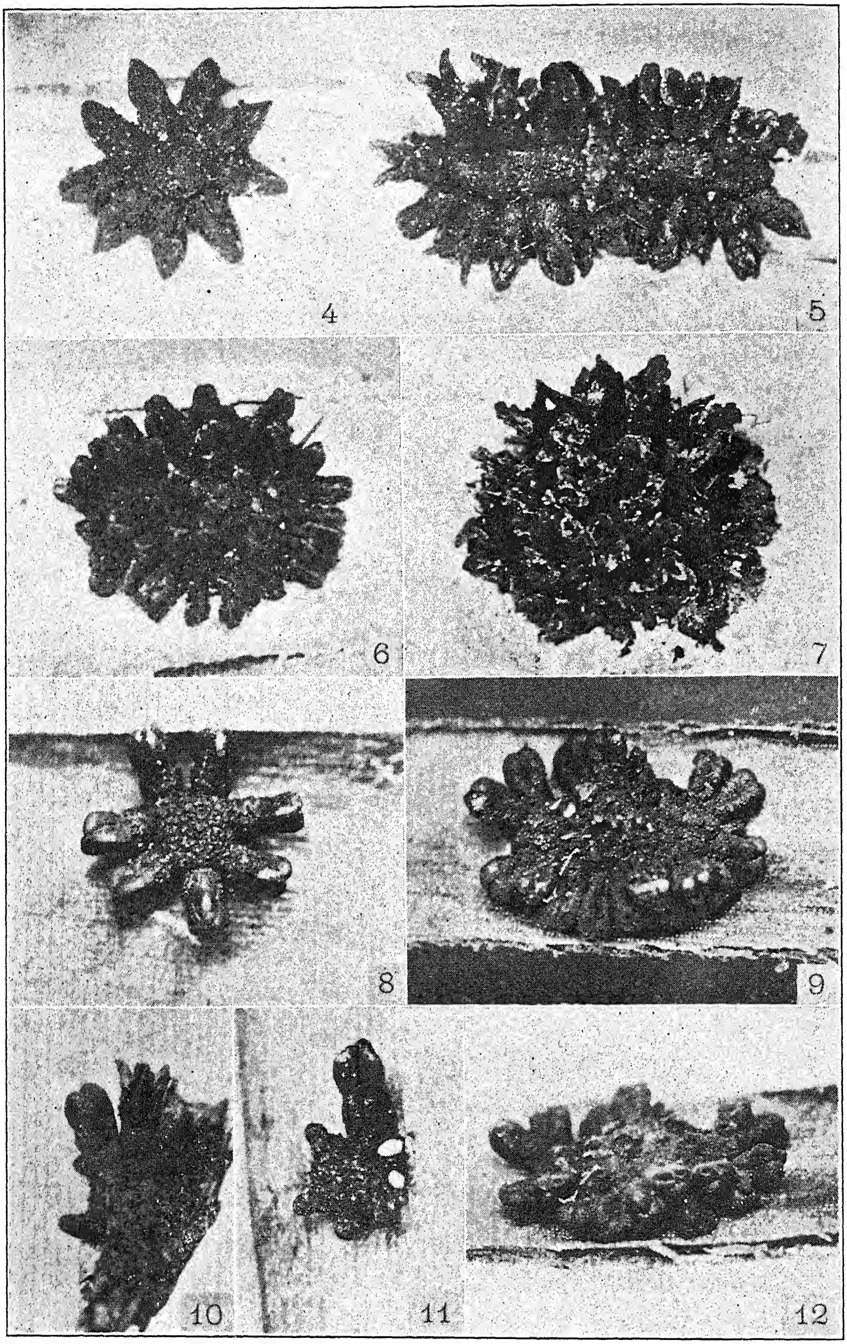
Fig. 32. *S. maxima.* Perithecia arising from a stroma at the base of a sorus of sporangia on the leaf of *Polypodium.* As a result of proliferation several perithecia are here shown in linear series. Material from Patouillard collected by Sodiro in Ecuador. × 11.

PLATE 17

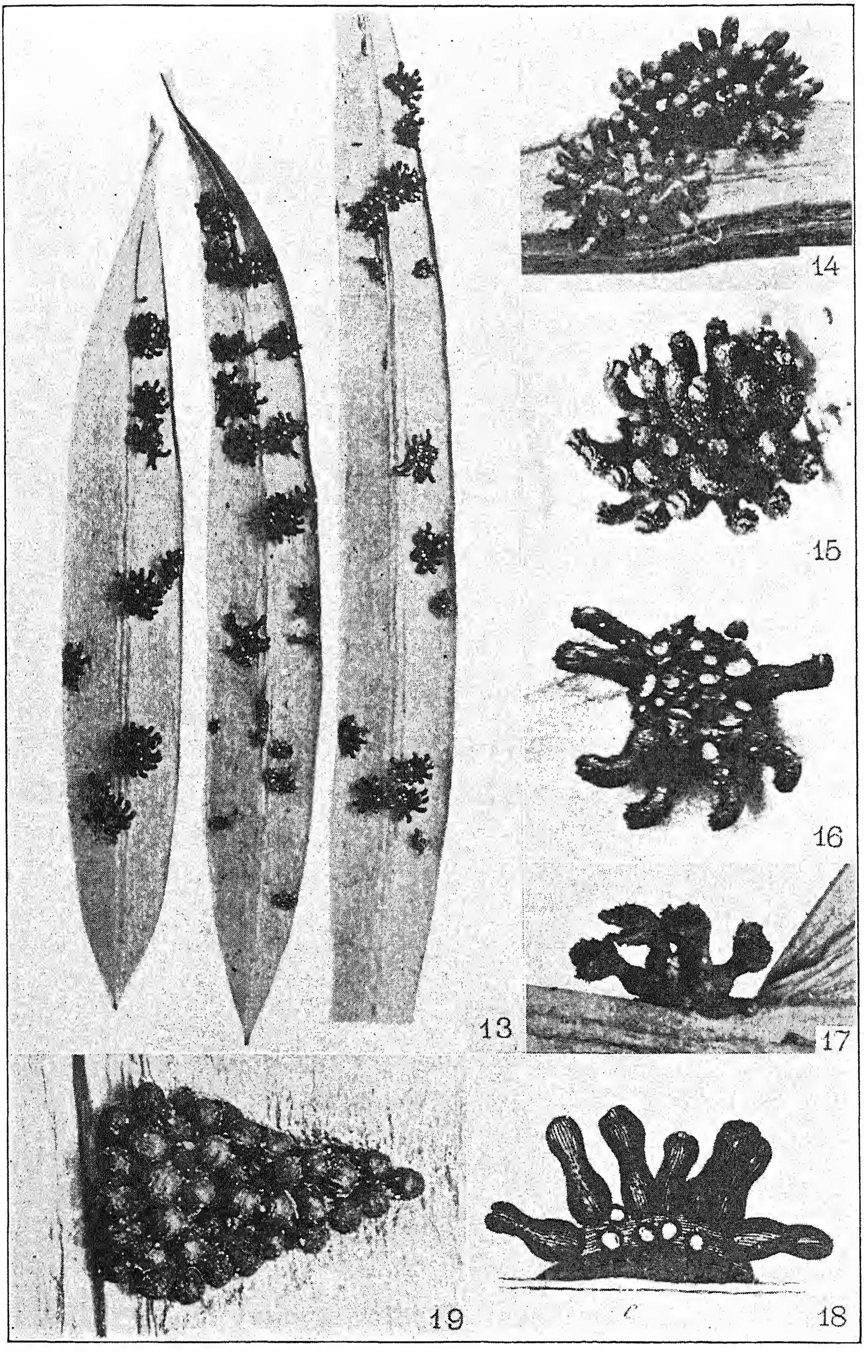
Fig. 33. *Caliciopsis pinea.* Perithecia arising from stromata on the bark of *Pinus strobus.* Type material from herbarium of Peck. × 11.



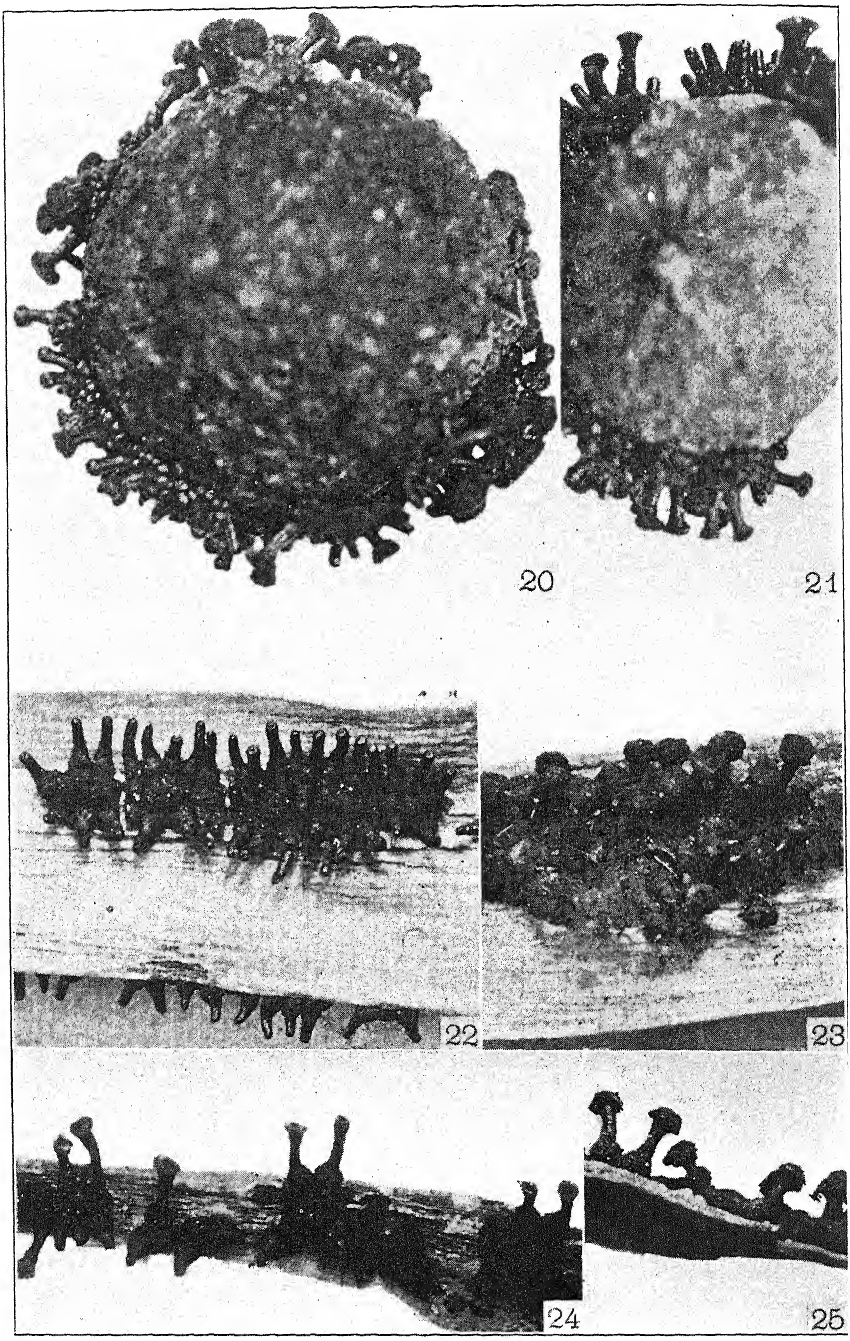
1–3. CORYNELIA PORTORICENSIS



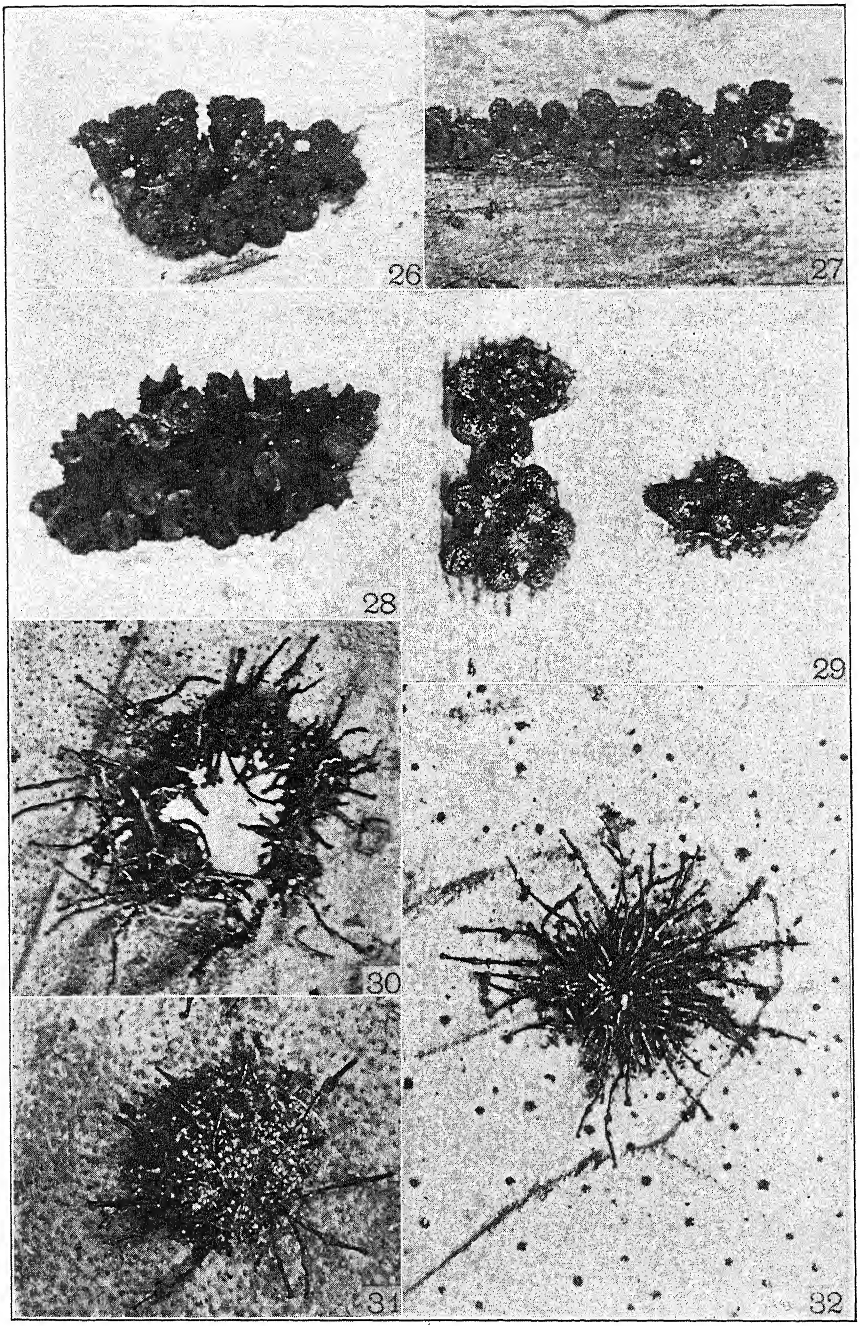
4, 5. CORYNELIA BRASILIENSIS
6, 7. CORYNELIA JAMAICENSIS
8–12. CORYNELIA OREOPHILA



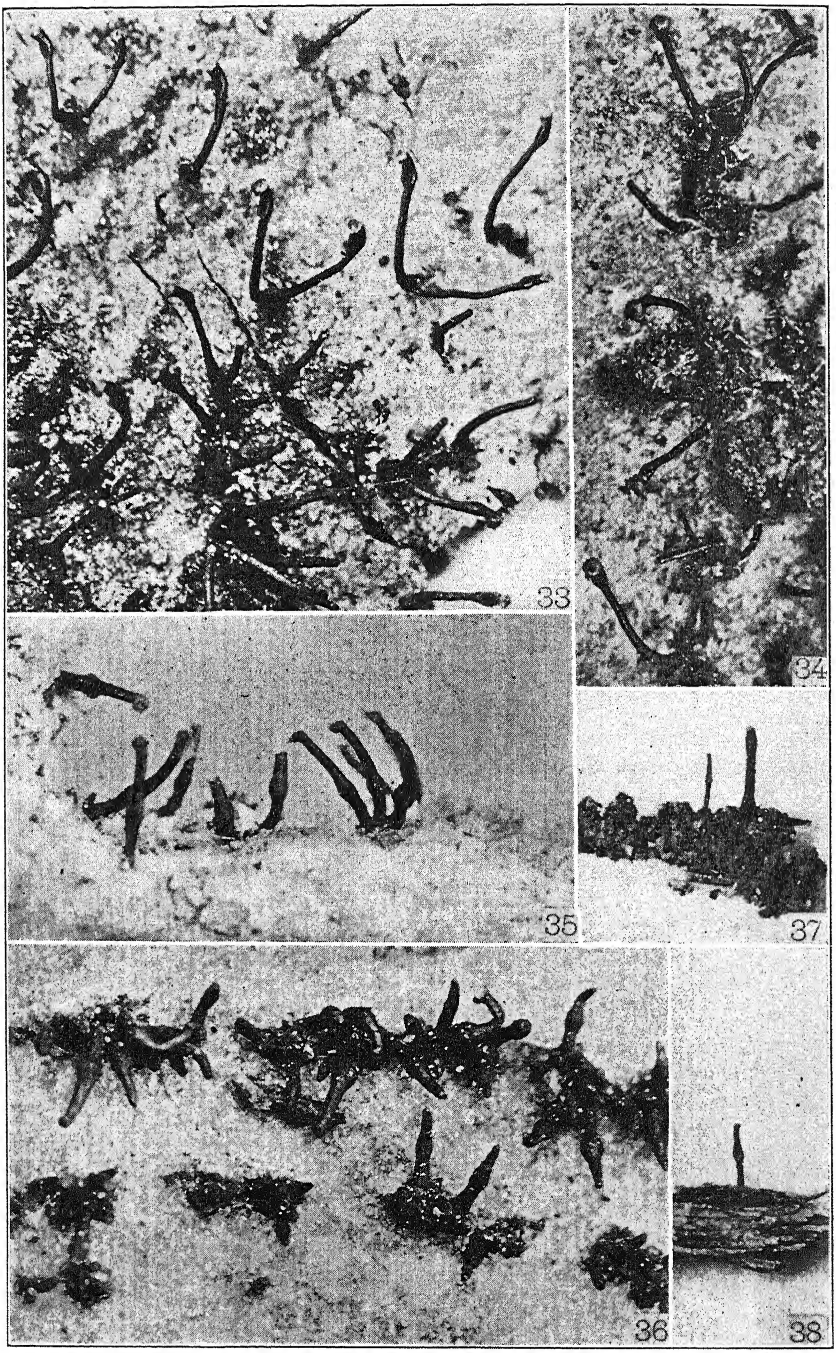
13–18. CORYNELIA UBERATA
19. CORYNELIA NIPPONENSIS



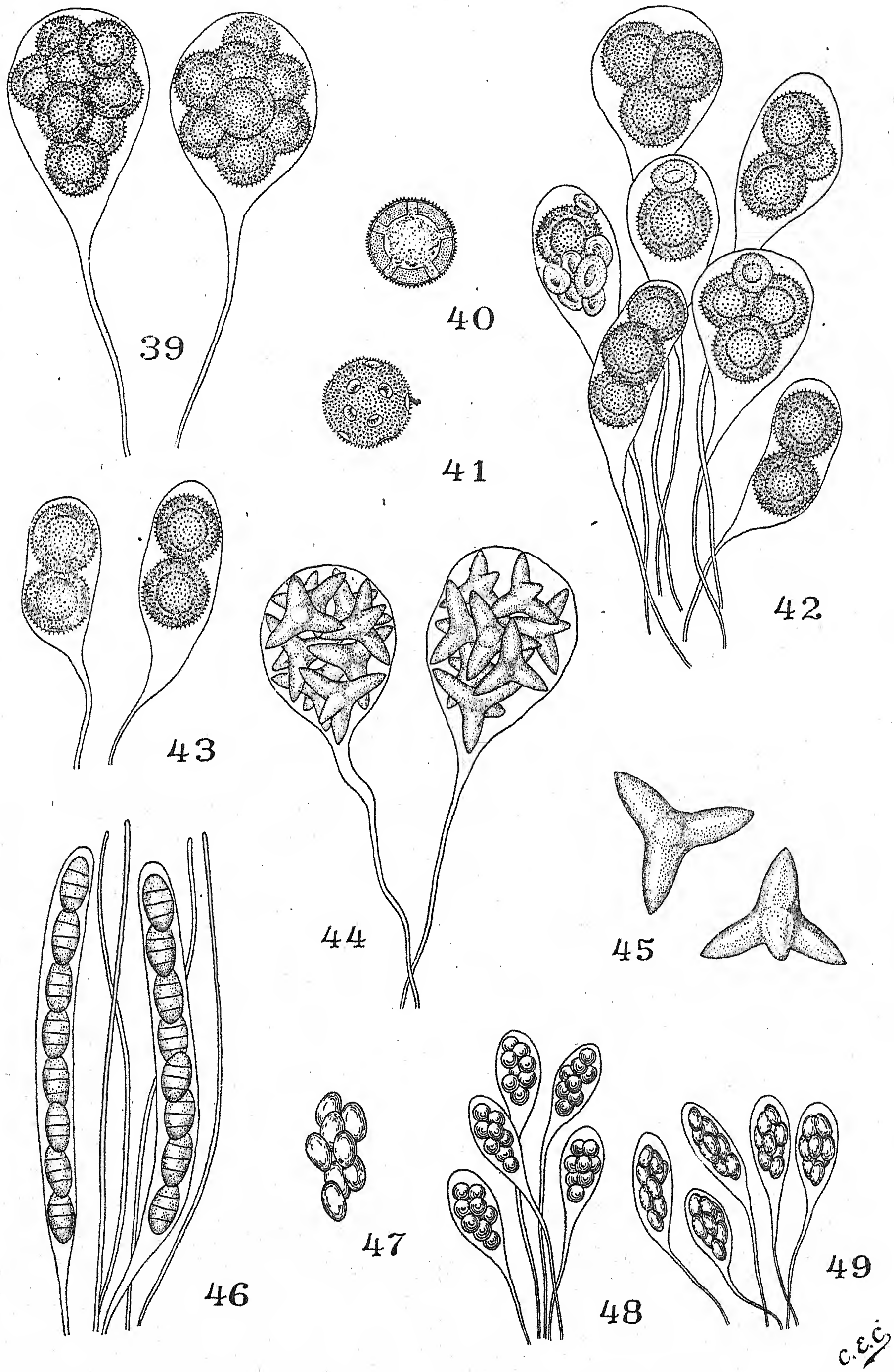
20, 21. Corynelia fruticola
22–25. Tripospora tripos



26–29. Corynelia tropica
30–32. Sorica maxima



33, 34. CALICIOPSIS PINEA
35, 36. CALICIOPSIS CALICIOIDES
37, 38. CALICIOPSIS SUBCORTICALIS



Microscopic Characters of the Coryneliaceae

MYCOLOGIA

Vol. XII — September, 1920 — No 5

MONOGRAPH OF THE CORYNELIACEAE

Harry Morton Fitzpatrick

(Continued from the July number)

4. Corynelia Fries ex. Acharius, Systema Mycologicum 2: 535. 1822

Corynelia Acharius, in Fries Obs. Mycol. 2: 343. 1818.

Type species, *Corynelia uberata* Fries ex Acharius.

Stromata black, formed within the host tissue, later erumpent, usually small and scattered, in *C. fructicola* confluent to form an effuse crust, bearing perithecia and in some species also pycnidia, perithecia seated on the stroma, cespitose, elongated (flask-shaped, barrel-shaped, top-shaped, clavate, etc.) the apex rounded and undifferentiated, or definitely lobèd, in *C. fructicola* flattened into a disc as in *Tripospora;* not provided with a typical ostiolum, at maturity dehiscent either by a wide opening resulting from one or more deep clefts, or as in *C. fructicola,* fimbriate-lacerate at the apex and finally dehiscent by a wide funnel-shaped opening; asci ovate to clavate, long-stalked, thin-walled, evanescent, usually 8-spored (varying from 1–8), aparaphysate; ascospores when young hyaline, smooth and by mutual pressure polyhedral; at maturity, spherical, brown, thick-walled, echinulate, unicellular; pycnidia seated on the stroma among the perithecia, more or less globose, black; pycnospores hyaline, elongated to fusiform, unicellular.

In this genus the ascospore is provided with a thin, echinulate epispore and a thick endospore. On young spores the echinulations are slightly developed or absent. The endospore at maturity is provided with a considerable number of definite circular thin-spots or perforations which are probably germ-pores. These

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apparently vary in number but in some cases certainly exceed fifteen.

KEY TO THE SPECIES OF CORYNELIA

A. Perithecium with a definite cylindrical neck broadened at the apex into a flattened disc; dehiscence by fimbriate-laceration, no definite cleft formed.

1. Asci 8-spored; stromata confluent to form an effuse crust; species on Rapanea (Myrsine).

1. *C. fructicola* (Figures 20, 21).

2. Asci 2-spored; stromata scattered; species on Podocarpus.

2. *C. bispora*[9] (Figure 43).

B. Perithecial neck lacking or if present then not broadened at the apex into a flattened disc; dehiscence by one or more definite clefts; all species on Podocarpus.

1. Apex of unopened perithecium not definitely lobed.

a. Perithecium barrel-shaped, more or less roughened and wrinkled, the apex flattened and the sides longitudinally grooved.

3. *C. tropica* (Figures 26–29).

b. Perithecium at maturity more or less dumb-bell shaped and frequently inequilateral, with a constricted middle portion, and a terminal swelling which is usually shaggy and traversed by several transverse parallel grooves.

4. *C. uberata* (Figures 13–18).

c. Perithecium top-shaped, the broadly rounded apex traversed by a single prominent shallow furrow.

5. *C. nipponensis*[10] (Figure 19).

d. Perithecium wedge-shaped at the apex, short-cylindrical below, dehiscence occurring along the sharp edge.

7. *C. brasiliensis* (Figures 4, 5).

2. Apex of unopened perithecium definitely lobed.

a. Apex typically 3-lobed, rarely 2- or 4-lobed, asci typically 8-spored.

6. *C. oreophila* (Figures 8–12, 39, 40).

b. Apex typically 2-lobed, in some individuals 3-lobed, asci typically 3-spored.

8. *C. portoricensis* (Figures 1–3, 41, 42).

c. Apex typically 3-lobed, in some individuals 4–5-lobed, asci typically 3-spored.

9. *C. jamaicensis* (Figures 6, 7).

1. CORYNELIA FRUCTICOLA (Patouillard) v. Höhnel, Sitzber. Kais. Akad. Wiss. Wien. **120**: 450. 1911

Capnodium fructicolum Patouillard, Journal de Botanique **3**: 258, 259. 1889.

[9] Dehiscent perithecia not yet seen, but dehiscence probably as in *C. fructicola*.

[10] Dehiscent perithecia not yet seen, but dehiscence by a single apical cleft is probable.

Corynelia carpophila Sydow, Botanische Jahrbucher von Engler 45: 264. 1910.

TYPE: in herbarium of Patouillard; portion of this communicated by Patouillard deposited as No. 1642 in herbarium of the writer.

(Figures 20, 21)

Stromata fructicolous, pulvinate, black; usually rounded, often laterally confluent to form an extensive, effuse, black crust which partially or completely envelopes the fruit; individual stromata 1 mm. or less in diameter, covered by a crowded cluster of perithecia frequently showing many stages of development on a single stroma; perithecium resembling closely that of *Tripospora tripos,* definitely flask-shaped, with a spherical to ovoidal, ascigerous, basal portion and a long, narrow cylindrical neck, rounded and blunt at the apex; the neck of the perithecium provided with a canal and in early stages marked at the apex with a minute umbilicus, but closed; in later stages the apex broadened to form a wide, slightly convex disc the diameter of which equals or exceeds that of the basal, ascigerous portion; this disc becoming fimbriate-lacerate, and assuming a reddish-brown, fuzzy appearance, finally dehiscent, the margin recurving, forming a funnel-shaped opening and exposing the lighter colored inner wall; asci $11–14 \times 20–25\,\mu$ (p. sp.), 8-spored; ascospores $6.5–10.5\,\mu$ in diam.; pycnidia present; pycnospores elongated to allantoid, hyaline, $4–6 \times 1\,\mu$.

Parasitic on *Myrsine africana* in India, on *Myrsine* sp. in China, and on *Rapanea melanophloeos* in South Africa. Not known on other hosts or from other localities.

The genera *Rapanea* and *Myrsine* are very closely related, being treated side by side in Das Pflanzenreich of Engler. In Engler und Prantl, Die Natürliche Pflanzenfamilien, the genus *Myrsine* is alone recognized, *Rapanea* being cited as a synonym.

Patouillard (34) described *Capnodium fructicolum* upon material collected by Delavay in China on a species of *Myrsine*. Later Sydow (51) described *Corynelia carpophila* upon material collected by Lane Poole in South Africa on Rapanea. Von Höhnel (22) saw material collected in India by Butler and from it concluded that *Capnodium fructicolum* is a species of *Corynelia* and probably identical with *Corynelia carpophila.* The writer

has compared the type material of *Capnodium fructicolum* with material of the original collection of *Corynelia carpophila* Sydow and with other South African material and has found them to be the same. He has also seen a portion of the material from India collected by Butler (52).

MATERIAL EXAMINED

Transvaal, S. Africa: Union Department of Agriculture, Mycological Herbarium No. 1736 (collected at Helpmakaar, Zoutpansberg, Aug. 5, 1911, identified by Sydow, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. No. 1503); Fitzpatrick Herb. No. 1748 (portion of original collection of *Corynelia carpophila* Sydow, obtained through the kindness of L. Romell from the herbarium at Dahlem).

Cape Province, S. Africa: Union Department of Agriculture, Mycological Herbarium No. 7795 (collected at Kentani, June 3, 1914, by A. Pegler, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. No. 1620; material also deposited at Harvard University, New York Botanical Garden and in Plant Pathology herbarium at Cornell University).

Southwest China, Province of Yun-nan: Herbarium of Patouillard (*type* collected by Delavay; communicated by Patouillard).

East India, Mussoorie: Herbarium Crypt. Ind. Orient on *Myrsine africana* (collected and communicated by E. J. Butler; deposited as Fitzpatrick Herb. No. 1643).

2. **Corynelia bispora** sp. nov.

Corynelia clavata f. macrospora Sydow, Deutsche Zentral-Afrika-Exped. 1907–1908 Unter Führnug Adolf Friedrichs 2: 100. 1910.

TYPE: original collection of *C. clavata f. macrospora* Sydow in herbarium of Sydow at Königl. Botanischer Garten und Museum at Berlin-Dahlem, Germany. Slides showing asci, mature ascospores, and pycnospores taken from a portion of the original material are deposited as No. 1722 in the writer's herbarium

(Figure 43)

Stromata scattered, small, hypophyllous; perithecia narrowly flask-shaped, the neck dilated at the apex to form a flattened tip resembling somewhat that of *C. fructicola,* but considerably narrower and consequently less prominent than in that species; method of dehiscence undetermined but probably by fimbriate-laceration as indicated by the slightly fuzzy appearance of the apex of the perithecium; asci 60×17–$20\,\mu$ (p. sp.), 2-spored; spores 11–15 μ in diam., pycnidia present; pycnospores hyaline, yellowish in mass, fusiform, 5–$8 \times 2\,\mu$.

Parasitic on *Podocarpus milanjiani* in central Africa. Known only from the original collection, and from the type locality near Ruwenzori.

The species is founded upon a fragmentary bit of the type material of *Corynelia clavata f. macrospora* Sydow. Only a single mature perithecium was obtained for study, but this was sufficient to show that the fungus is very unlike *C. clavata* (*C. uberata*) and cannot be regarded as a variety of that species. It is probable that a critical examination of the remainder of the original collection at Berlin would make possible a more complete description of the fungus, particularly with reference to the method of dehiscence of the perithecium.

Sydow (50) states that *Corynelia clavata f. macrospora* differs from the type species in its larger spores, 10–17×10–$14\,\mu$, but agrees in all of its other characters. He states further that the spores of the type never exceed 9–11 μ. The writer's observations differ from those of Sydow in several essential points. In *C. clavata* measurements of spores from a number of collections show that mature spores average 12 μ in diameter and frequently reach 14 μ, thus considerably exceeding the limit set by Sydow. In *C. clavata f. macrospora* the spores measure 11–15 μ in the fragment examined but fail to reach the maximum diameter of 17 μ given by Sydow. The 2-spored asci serve to distinguish the fungus from *C. clavata;* moreover the appearance of the perithecium in the two forms is not the same. Several dozen 2-spored asci may be clearly seen in the slide deposited in the writer's herbarium and no variation from the 2-spored condition has been observed.

3. CORYNELIA TROPICA (Auerswald & Rabenhorst) Starbäck, Arkiv. for Botanik **5**: 18–20, *pl. 1, fig. 14.* 1905

Endohormidium tropicum Auerswald & Rabenhorst, Hedw. **8**: 89. 1869. (Rabenhorst Fungi europaei No. 1261 distributed in 1869, bears the same description, and contains a figure drawn by Fleischhak.)

Trullula tropica (Auerswald & Rabenhorst) Saccardo, Sylloge Fungorum **3**: 732. 1884.

Corynelia clavata (Linnaeus) Saccardo f. *andina* P. Hennings, Hedw. **36**: 230. 1897.

Corynelia clavata (Linnaeus) Saccardo p.p., in Rehm, Hedw. **37**: 328. 1898; Hennings, Hedw. **39**: 76. 1900; Saccardo, Sylloge Fungorum **16**: 650. 1902.

ILLUSTRATIONS: Fleischhak in Rab. Fung. Europ. 1261; Starbäck, Arkiv för Botanik **5**: *pl. 1, fig. 14.*

TYPE: Rabenhorst Fungi Europaei No. 1261. Material of this collection showing both asci and spores seen by the writer. (Prepared slide No. 1212a in Fitzpatrick herbarium shows asci and spores.)

(Figures 26–29)

Stromata amphigenous (chiefly hypophyllous) and caulicolous, not reported as fructicolous, usually irregular in outline, not characteristically circular, frequently much elongated, especially when erumpent along the midrib or along the edge of the leaf, occasionally elongated at right angles to the long axis of the leaf, 1–2 × 1–7 mm., dull black, rough, in section dark brown, bearing 10–50 or more crowded perithecia; perithecia erumpent, irregularly arranged on the stroma and less uniform in appearance than those of other species of the genus; immature perithecia globose or irregular due to crowding, later becoming characteristically barrel-shaped, the upper end more or less flattened and the sides marked with 6–8 parallel longitudinal grooves, the whole surface irregularly roughened by warts and wrinkles, dull black to brownish black, 0.5–1.0 mm. in length, slightly less than 0.5 mm. in width, carbonaceous; the apex of the mature perithecium marked by a faint transverse line along which dehiscence occurs, dehiscent by a wide and deep split, the two lips pulling apart and exposing the brownish-red interior of the perithecium; the margins of the lips tending to become fimbriate-lacerate and giv-

ing the fuzzy appearance seen in *C. fructicola;* asci 17–25 × 25–37 μ (p. sp.), 8-spored (rarely a 4-spored ascus or one in which some of the spores are imperfectly formed found); spores 9–12.5 μ (mostly 11 μ) in diameter.

Parasitic on *Podocarpus saligna, P. chilina* and *P. andina* in Chili, and on *P. costata* in the Philippine Islands. Not reported from other regions.

The specimens from the Philippine Islands included here contain in most cases only immature perithecia. Asci and mature spores have been observed in one collection, and are indistinguishable from those of South America material of *C. tropica*. The examination of additional Philippine material is desirable, especially since dehiscent perithecia have been observed only in the South American material. Although the fungus from the Philippines seems to differ in certain minor respects from South American specimens of *C. tropica* it certainly agrees more closely with this species than with any other as yet described, and in the present state of our knowledge the erection of a new species seems unwarranted. Rehm (44) Baker (3, 4), and others are clearly in error in regarding the Philippine fungus as *C. uberata.*

Auerswald and Rabenhorst (2) who first described *C. tropica* under the name *Endohormidium tropicum* state in their description of the species that the perithecium lacks an ostiolum. Had they found asci they doubtless would have placed the fungus in the Perisporiaceae. Neither Hennings (18, 20) nor Starbäck (48), who later studied the species, say anything concerning the dehiscence of the perithecium. Since they place the species in the Coryneliaceae, they may, however, be assumed to have believed that an ostiolum is present. Material of this species showing the method of dehiscence has been seen by the writer in only three specimens.[11] It may be safely assumed that these earlier writers never saw dehiscent perithecia. The appearance of the young perithecium gives no indication of an apical split, and the line of dehiscence seen on mature perithecia is not prominent.

Léveillé (27) describes *Sphaeronema clavatum* from material

[11] No. 1261 Rabenhorst, Fungi europaei in Herb. Rehm at Stockholm, Sweden, and No. 4261 Rabenhorst-Pazschke, Fungi europaei et extra-europaei at Purdue Univ., and at Harvard Univ.

on *Drymis chilensis* DC. collected by Gay in Chili and deposited in the herbarium of the Museum of Paris. Jaczewski (24) in connection with the preparation of his monograph of Sphaeronema reëxamined this specimen and found two fungi present. One of these, a pycnidial form, he recognized as *Sphaeronema clavatum* Lév., but transfers it to *Aposphaeria* under the name *A. clavatum* Jaczewski. The other a perithecial form which had meanwhile been incorrectly labeled in the herbarium *Corynelia clavata* Montagne, he refers to the genus *Caliciopsis* Peck. His description of the fungus is extremely interesting in several respects. He states that a section through the perithecium reveals a distinct stalk and an ovoid receptacle which is at first closed but later opens *by a large cleft at the tip*. He also states that the asci are long-stalked, ovoid, surrounded by paraphyses and contain 8 globose, brown, 1-celled spores, 7.5 μ in diameter. He publishes also figures showing a perithecium and an ascus. There is little doubt that this material represents a species of the Coryneliaceae and the description of the method of dehiscence by a wide cleft is the only one recorded in literature for any species of the group. There is also reason to believe that this material was in reality *C. tropica*. In the phanerogamic herbarium at Harvard University there is a specimen of *Podocarpus chilina* collected by Gay in Chili and sent to Harvard from the herbarium of the Museum of Paris. This specimen bears no number or other identifying label. On the leaves of this specimen the writer has found perithecia of *C. tropica*. Since the specimen in the herbarium at Paris which was examined by Jaczewski was also collected in Chili by Gay and since no species of *Corynelia* has been found on *Drymis* there is reason to suspect that this specimen was in reality *Podocarpus* and perhaps identical with the Harvard material. The host genera are not closely related but their leaves could be confused in poor specimens.

MATERIAL EXAMINED

Chili: Rabenhorst, Fungi europaei No. 1261 (*type* material: at N. Y. Bot. Gard., in Herb. H. Rehm, Stockholm, Sweden, and in Plant Path. herb. at Cornell Univ.); Rabenhorst-Pazschke,

Fungi europaei et extraeuropaei No. 4261 (in Bot. Dept. herb. at Harvard Univ., in Bot. Dept. herb. in Indiana Agric. Exp. Sta., Purdue University, in herb. H. Rehm, Stockholm, Sweden, and in U. S. Dept. Agric. Plant Industry herb.); Rehm, Ascomyceten No. 1326b (herb. H. Rehm, Stockholm, Sweden, and herb. C. E. Fairman, Lyndonville, N. Y.; the two specimens in Bot. Dept. herb. at Harvard Univ. are *C. oreophila*); Fitppatrick Herb. No. 1569 (material found in phanerogamic herbarium at Upsula, Sweden, on leaves of *Podocarpus chilina* distributed as No. 467 W. Lechler Pl. Chilenses Ed. R. F. Hokenacker; communicated by O. Juel); Fitzpatrick Herb. Nos. 1485, 1486, and 1487 (material found in phanerogamic herbarium at Harvard Univ. on leaves of *P. chilina* collected by H. Alabar, K. Ocksenius, and C. Gay respectively; communicated by A. J. Eames); Fitzpatrick Herb. No. 1374 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *P. chilina*, obtained in exchange from Herb. Mus. Paris); Fitzpatrick Herb. No. 1193 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *P. saligna* collected by Philippi).

Philippine Islands: Baker, Fungi Malayana No. 130 (in U. S. Dept. Agr. Bur. Pl. Industry Herb.; in Herb. Bur. Sci. Philippine Islands, Manila; and at Harvard Univ.); Nos. 851, and 7542 Herb. Bur. Sci. Philippine Islands, Manila; Fitzpatrick Herb. Nos. 1560, 1566, and 1721 (material collected on *Podocarpus costata* on Mt. Banajao, Laguna Province by Otto Reinking and E. B. Copeland; communicated by the collectors); Nos. 851 and 3639 Herb. H. Rehm (material collected by E. B. Copeland on Mt. Banajao); No. 910 Herb. H. Rehm (material collected on Mt. Banajao by F. C. Gates).

4. CORYNELIA UBERATA Fries ex. Acharius, Systema Mycologicum 2: 535. 1822

?*Mucor clavatus* Linnaeus fil. Species Plantarum Suppl. 453. 1781.

?*Lichen* (*Calicium*) *helopherus* Acharius, Lichenographiae Svecicae Prodromus 86, 1798.

?*Sphaeria turbinata* Persoon, Synopsis Methodica Fungorum 95. 1801.

Corynelia uberata Acharius, in Fries, Observationes Mycologicae **2**: 343, 344, *pl. 8, fig. 1 a–e.* 1818.

Corynelia clavata (Linnaeus) Saccardo, in R. Pirotta, Osservazioni sopra alcuni funghi. Nuovo Giornale Botanico Italiano **21**: 312–317. 1889.

ILLUSTRATIONS: Fries, Observationes Mycologicae **2**: *pl. 8, fig. 1, a–e.* Winter, Ber. Deut. Bot. Gesell. **2**: *figs. 4–8.* Cooke, Handbook of Australian Fungi, *fig. 242.* Lindau, in Engler und Prantl, Die Natürliche Pflanzenfamilien **1**^{1}: *fig. 261 a–c.*

(Figures 13–18)

Stromata scattered, infrequently confluent, more or less definitely circular, 1–3 mm. in diameter, chiefly hypophyllous, but often amphigenous, caulicolous, and fructicolous, not usually erumpent before the delimitation of the perithecia, in section homogeneous and black or dark-brown, externally dull black and minutely roughened, bearing finally a crowded cluster of 20–50 or more perithecia; perithecia first making their appearance through the ruptured epidermis as hemispherical protuberances on the stroma, the ascigerous cavity being partially buried and pure white within; the young perithecium cartilaginous, soon attaining a characteristically conical form, the apex smooth and shining, the base rough and dull, later protruding farther and developing a cylindrical neck which becomes clavate by the pronounced enlargement of the tip; perithecium at maturity approximately 1 mm. in length, brittle, somewhat dumb-bell shaped, usually bent in the narrow, middle portion and appearing consequently inequilateral, this being especially pronounced in those individuals borne at the margin of the stroma; the swollen apex of the perithecium at maturity flattened and deeply cleft by one to several transversely running furrows, the resulting ridges usually breaking up into scales, giving the apex of the perithecium a pronouncedly shaggy appearance, finally dehiscent along the line of the middle furrow by a wide and deep split, the two lips pulling apart and usually recurving thus exposing the ashy to brown inner wall; asci $20–26 \times 34–44\,\mu$ (p. sp.), 8-spored; spores $9–14\,\mu$ (mostly $12\,\mu$) in diam.; pycnidia sometimes developed on the stroma; pycnospores elongated, $5–7 \times 2\,\mu$.

Parasitic on *Podocarpus elongata, P. latifolia, P. Nageia, P.*

Thunbergii, P. costata, P. falcata, and *P. gracilior.* Known thus far only from Africa, Japan, New Zealand (Cooke 8) and the Philippine Islands, but probably occurs throughout the tropical and subtropical regions of the Eastern Hemisphere. It has presumably also a considerably wider host range.

There is evident in different collections of material considerable variation in the size and general appearance of the perithecia. In the material from Japan they are somewhat smaller than those of South African specimens. No other differences have, however, been correlated with these variations, and the writer believes that a single species is represented.

The material studied by the writer agrees well with the colored illustrations and the description of *Corynelia uberata* published by Acharius in the Observationes Mycologicae of Fries (12). Acharius in connection with this description cites *Mucor clavatus* L. and *Sphaeria turbinata* Pers. as synonyms. Moreover he (Acharius 1) cites *Mucor clavatus* as a synonym in connection with the original description of *Lichen* (*Calicium*) *helopherus*.[12] No explanation of his failure to cite *L.* (*Calicium*) *helopherus* in the synonymy of *Corynelia uberata* can be given. Fries (13) uses the name *C. uberata* in Systema Mycologicum but Saccardo (45) selecting the earlier specific name of Linnaeus designates the species as *C. clavata* (L.) Sacc. Because the latter binomial has come into more common use in recent years it is important that the identity of *C. uberata* and *Mucor clavatus* be demonstrated if possible. We cannot be sure from an examination of literature that the specimens on which these two species were based were ever compared. The name *Mucor clavatus* was first used by the younger Linné (29) in connection with the follow-

[12] Fries in connection with the description of *C. uberata* in Systema Mycologicum cites *Lichen* (*Calicium*) *colpodes* Acharius as a synonym. This is evidently a mistake in citation since this species is given as *Lichen* (*Imbricaria*) *colpodes* by Acharius, and from the description clearly refers to another organism. Fries apparently had in mind *Lichen* (*Calicium*) *helopherus* Acharius which was collected at the Cape of Good Hope and is stated by Acharius to be identical with *Mucor clavatus* Linnaeus. It is worthy of note, however, that in the description of *Corynelia uberata* signed by Acharius in Observationes Mycologicae the name *Lichen helopherus* is omitted from the synonymy.

ing description: "*clavatus. Mucor perennis, stipite filiformi nigro, capitulo obtuso nigro glabro. Habitat in foliis Arborum. Refert puncta in frondibus Filicum.*" He fails to state where he obtained his material and the description certainly cannot be regarded as applying unquestionably to *C. uberata.* The identity of the two forms could be demonstrated, therefore, only by a comparison of the type materials. An authentic sypecimen of *Mucor calvatus* probably does not exist. The herbarium of Linnaeus and that of Sir J. E. Smith with which many of the younger Linné's specimens are incorporated have been examined for the writer by Miss E. M. Wakefield. She states that the only specimen in the herbarium bearing the name *Mucor clavatus* is labeled in an unknown handwriting, is on bark, not leaves, and is not a *Corynelia* at all, but *Calosphaeria princeps* as noted on the sheet by Berkeley and Massee. Moreover although Acharius, Persoon, and Fries cite *Mucor clavatus* in their publications an authentic specimen of this species is not present in any of their herbaria today.

A specimen of recently collected material from South Africa communicated by Miss Doidge was mailed to Professor O. Juel, curator of the herbarium of Elias Fries, with the request that he compare it with the original material of *Corynelia uberata* deposited at Upsala. He has supplied the following facts. A single specimen in the herbarium bears a label written by Fries as follows: "*Corynelia uberata* Fr. Cap. B. sp. Dedit Acharius, Exiguum, at characterist." It consists of a fragment of a leaf bearing two stromata, only one of which is well developed. Most of the perithecia have been broken away, only one or two being in good condition. These are, however, of the same shape and size as those on the specimen from Miss Doidge submitted for comparison. Since this specimen in the herbarium of Fries was received from Acharius and since it is the only specimen in the herbarium labeled by Fries as *Corynelia uberata,* we are justified in believing that it constitutes a portion of the type material of this species. Moreover in the herbarium of Thunberg at Upsala there is another specimen, also fragmentary, which bears the same data as the specimen of Fries and agrees with it in

every essential respect. This was, however, erroneously labelled *Sphaeria capitata*.[13] These two specimens are unquestionably according to Juel, parts of a single collection of material made by Thunberg on *Podocarpus falcata* at the Cape of Good Hope.

Authentic material of *Lichen* (*Calicum*) *helopherus* and *Sphaeria turbinata* are probably no longer in existence. A search for specimens of these species has been made for the writer in the herbarium of Acharius at Helsingfors, Finland, and in that of Persoon, at Leiden, Netherlands, but without success. Since Persoon (39) states that his material was received from Thunberg there is some reason for suspecting that *Sphaeria turbinata* Pers., *Lichen* (*Calicium*) *helopherus* Acharius, and *Corynelia uberata* Acharius were all founded on a single collection of material made by Thunberg (53 54) at the Cape of Good Hope. The descriptions were all prepared in such a manner, however, that a reasonable doubt remains as to the identity of the three forms. There is no reason for believing that any of these workers saw other than the material on which his own description was based. It seems best from every standpoint to accept for the species under consideration the name *Corynelia uberata*. There is certainly no justification for using the binomial *C. clavata* (L.) Sacc.

Corynelia clavata f. fructicola is the name applied by Rehm (43) to material collected at the Cape of Good Hope on *Podocarpus elongata*, and distributed as No. 1326a of Rehm's Ascomyceten. The name was applied to specimens occurring on the fruit of the host in contrast to those found on the leaves (*f. foliicola*). The writer has examined the specimen in Rehm's own herbarium, and feels that the use of these form names is undesirable since the fungus on the leaves is morphologically identical with that on the fruit. An examination of two sets of the same exsiccati shows that Rehm distributed as No. 1326b. under the name *C. clavata* a mixed lot of material of *C. oreophila* and *C. tropica* collected in Chili by Neger.

13 Same as *Xylaria Schweinitzii* B. & C.

MATERIAL EXAMINED

Cape Province: Rabenhorst-Winter, Fungi europaei No. 3149 (specimens in Ellis and Earle herbaria at N. Y. Bot. Gard., in Plant Path. herb. at Cornell University, and two numbers in herb. Rehm at Stockholm); de Thümen Mycotheca universalis No. 776 (in N. Y. Bot. Gard. Herb., and in Bot. Dept. Herb. at University of Michigan); Fitzpatrick Herb. No. 1197 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaves of *Podocarpus elongata* distributed in Cape Fl. Spec. by Steudel of Esslingen, Germany); Fitzpatrick Herb. No. 1483 (material found in phanerogamic herbarium at Harvard Univ. on leaves of *Podocarpus sp.* collected by Harvey, and labeled ex. Herb. Collegii S. S. Trin. Dublin); Union Department of Agriculture, Mycological Herbarium Nos. 986, 5580, 7354, 7815, 8970, 8971, and 9739 (collected in various localities and on several different hosts, communicated by Miss Ethel M. Doidge, and deposited as Fitzpatrick Herb. Nos. 1622, 1613, 1621, 1614, 1617, 1616, and 1619 respectively); Rehm Ascomyceten No. 1326a (specimen in Herbarium of Rehm); Union of South Africa, Dept. Agric., Natal Herb. Nos. 917, 918 (material communicated by van der Bijl, and deposited in Fitzpatrick Herb. as Nos. 1575 and 1576 respectively; material of No. 1575 deposited also at Harvard University, at New York Botanical Garden, and as No. 12059 in Plant Path. herbarium at Cornell University); Fitzpatrick Herb. Nos. 1564 and 1565 (two additional collections of material communicated by van der Bijl).

Transvaal: Sydow, Fungi exotici exsiccati No. 185 (in N. Y. Bot. Gard. herb., in Plant Path. herb. at Cornell Univ., and in herb. Bur. of Sci., Manila); Union Department of Agriculture, mycological herbarium Nos. 1743, 7410, and 1770 (communicated by Miss Ethel M. Doidge, and deposited in Fitzpatrick herbarium as Nos. 1504–1506 respectively).

Zululand: Union Department of Agriculture, mycological herbarium No. 2027 (collected at Eshowe by J. B. Pole-Evans, communicated by Miss Ethel M. Doidge, and deposited in Fitzpatrick Herbarium as No. 1618).

Tropical East Africa: Fitzpatrick Herb. No. 1195 (material found in phanerogamic herbarium at N. Y. Bot. Garden. on leaves of *Podocarpus gracilior* collected by Whyte in 1898 and communicated by Roy. Hort. Bot. Gard. Kew); U. S. D. A. Bur. Pl. Ind. herb. (material found in phanerogamic herbarium of U. S. Nat. Museum on leaves of *P. gracilior*, No. 630548, collected by E. A. Mearns).

Japan: Fitzpatrick Herb. No. 1639 (material collected by S. Kawagae on Yaku Island, Prefecture Kagoshima on *Podocarpus Nagcia*, communicated by G. Yamada, Morioko, Japan).

Philippine Islands, Laguna, Luzon: Fitzpatrick Herb. No. 1750 (material communicated by Otto Reinking).

5. **Corynelia nipponensis** sp. nov.

TYPE: in Fitzpatrick Herb. Nos. 1204 and 1644.

(Figure 19)

Stromata scattered, 1–4 mm. in diameter, hypophyllous, elongated at right angles to the long axis of the leaf, the epidermis rupturing by a definite transverse slit, occasionally more or less circular, bearing a crowded cluster of 10–40 or more perithecia; perithecium top-shaped, the sides tapering toward a narrowed base, smooth, the broad flat apex more or less rounded, and traversed by a shallow furrow which evidently marks the line of dehiscence; ruptured perithecia not seen; perithecia crushed, on the slide shown to consist of long, brown, parallel hyphae which give a characteristic and diagnostic appearance; asci $30–42 \times 17–27\,\mu$ (p. sp.), 8-spored; spores $8.5–11\,\mu$ (mostly $10\,\mu$) in diam.

Parasitic on *Podocarpus macrophylla* Don. in Japan.

Only a single collection of this species is known to the writer. Material of *Podocarpus macrophylla* collected in Japan was received at the Royal Botanic Gardens at Kew in January, 1893, from the Science College of the Imperial University of Japan and was placed in the phanerogamic herbarium. The place and date of the collection and the collector's name are unknown. George Massee found material of a species of *Corynelia* on this specimen and placed it in the cryptogamic herbarium. This is labeled in

his own handwriting: "*Corynelia uberata* Fr. on *Podocarpus macrophylla* Don., Japan." A portion of this specimen was later sent to the New York Botanical Garden and is in the herbarium there. The writer has studied the specimen in the New York Botanical Garden, and has received also for comparison a portion of the material deposited at Kew. The two specimens are clearly the same thing. The fungus is not, however, *Corynelia uberata*. The perithecia are of greater diameter than those of *C. uberata*, and differ from them in shape and general appearance. It is unfortunate that more material showing the fungus in all stages of development is not available for examination, but there can be no doubt that this represents a hitherto undescribed species. It is of interest to note that *C. uberata* also occurs in Japan.

6. CORYNELIA OREOPHILA (Spegazzini) Starbäck, Arkiv. för Botanik 5: 18–20, *pl. 1, fig. 13 a–c.* 1905.

Alboffia oreophila Spegazzini, Anal. Mus. Nac. Buen. As. 6: 295, 296. 1898.

Corynelia clavata (Linnaeus) Saccardo p.p., Sylloge Fungorum 16: 650. 1902.

ILLUSTRATIONS: Starbäck, Arkiv för Botanik 5: *pl. 1, fig. 13 a–c.* 1905.

TYPE: The type material of *Alboffia oreophila* has been lost. Professor Spegazzini, in whose herbarium it was originally deposited, has, however, mailed to the writer material of another collection which he regards as the same. This material though young is unquestionably *Corynelia oreophila*. The original material on which *C. oreophila* was based is No. 301 Herb. Robt. Fries in the Riksmuseets Vetenskapsakademien, Stockholm, Sweden. A portion of the latter was communicated to the writer by L. Romell and is No. 1577 Fitzpatrick Herb.

(Figures 8–12, 39–41)

Stromata scattered, usually definitely circular to elliptical in outline, often erumpent before the delimitation of the perithecia, subcarbonaceous, the interior homogeneous and black, the surface

black and rough, amphigenous (chiefly hypophyllous, but a single stroma sometimes erumpent on both surfaces of the leaf), not observed to be caulicolous or fructicolous, bearing 7–100 or more perithecia; perithecia large, reaching 1.5 mm. in length, approximately 0.5 mm. in lateral diameter, in some cases much crowded and covering the whole surface of the stroma, in others scattered or developed only at the margin; young perithecium conical to short cylindrical, the apex smooth, rounded, and undifferentiated, the ascus-bearing cavity partially buried in the stroma, pure white within and the surface roughened with minute markings; mature perithecium very characteristic, the lower half globose to subcylindrical and roughened like the stroma, the upper half trisulcate and trilobed giving a triangular appearance in transverse section, smooth to shiny, the apex subtruncate and trilobed-umbilicate, the apical furrows running half way down the sides of the perithecium; dehiscence taking place along these furrows, the upper half of the perithecium becoming deeply tri-cleft, the three lobes pulling apart and turning back, exposing the lighter colored inner surface of the perithecial wall and giving a 3-pronged apex; in rare cases one or more perithecia on a stroma showing only a bilobed apex and resembling closely the typical perithecium of *C. portoricensis;* in other cases, an occasional perithecium quadrilobed, a condition also met with in *C. jamaicensis;* asci ellipsoidal to ovate, 22–30 × 34–42 μ (p. sp.), typically 8-spored, asci containing a fewer number of spores uncommon; spores 10–13.5 μ (mostly 12–13.5 μ) in diameter.

Parasitic on *Podocarpus angustifolia, P. Sellowii, P. chilina,* and *P. macrostachys.* Probably occurs also on other species of this genus. The type material collected on *P. angustifolia.*

Corynelia oreophila, C. portoricensis, C. jamaicensis, and *C. brasiliensis* are very closely related species. Of these *C. brasiliensis* is easily separated from the others by the wedge-shaped apex of its perithecium. *Corynelia oreophila* may be distinguished from the remaining two by its typically 8-spored ascus. In the material of this species studied less than 5 per cent. of the asci contain fewer than eight spores. A few 6-spored asci, fewer 5-spored asci, and one 2-spored ascus have been observed. This variation is not correlated with the variation in the number of lobes at the apex of the perithecium. Slides made from bilobed and quadrilobed individuals show typically 8-spored asci. In *Corynelia portoricensis* and *C. jamaicensis* approximately 80 per

cent. of the asci are 3-spored and the majority of the remainder are 2-spored. In relatively rare cases 1-spored, 4-spored, or 8-spored asci have been found, but when more than three spores occur in an ascus some of the spores are often imperfectly formed. One ascus with a single large normal spore and seven minute probably non-functional spores have been seen in *C. portoricensis* (Figure 42), but an ascus with eight perfectly formed, normal spores has not been observed in either of the two species.

The perithecium of *C. oreophila* is typically trilobed at the apex, bilobed and quadrilobed individuals occurring on the stroma among the typical individuals only in rare cases. In *C. portoricensis* the perithecium is typically bilobed but the occurrence of trilobed individuals is not uncommon, comprising approximately 11 per cent. of the cases. A quadrilobed individual has not been seen in this species. In *C. jamaicensis* the perithecium is typically trilobed and occasionally quadrilobed. Moreover a pentilobed apex has been noted on a single individual, but a perithecium with a bilobed apex has not been observed.

The perithecia are approximately the same size in the four species though there is some variation. The spores in *C. oreophila* and *C. brasiliensis* are somewhat smaller than those of *C. portoricensis* and *C. jamaicensis*. This fact is probably correlated with the number of spores in the ascus in the various cases. It has been observed that in *C. portoricensis* and *C. jamaicensis* the spore in a 1-spored ascus is relatively very large, the spores in a 2-spored ascus smaller, and those in a 3-spored ascus even smaller. This condition is probably merely a result of difference in nutrition.

The species *C. brasiliensis, C. jamaicensis,* and *C. portoricensis* have been founded on relatively few collections of material. *Corynelia oreophila* has, however, been studied from five widely separated localities in South and Central America. These five collections are identical as regards ascus and perithetical characters and show no more tendency in one case than in another toward the development of few-spored asci like those of *C. portoricensis* and *C. jamaicensis*. There is no reason, there-

fore, to assume that additional collections of material would furnish conditions intermediate between these species. Though admittedly closely related, they must be regarded as sharply demarcated and distinct. In the introduction to this paper an attempt is made to show how they have arisen from a common ancestor.

MATERIAL EXAMINED

Brazil: Herb. H. Rehm, No. 1881, Stockholm, Sweden (two packets of material collected by Ule, April, 1892); Fitzpatrick Herb. No. 1192 (material found in phanerogamic herbarium at N. Y. Bot. Gard. on leaf of *Podocarpus Sellowii* collected by Sellow and communicated to Herb. Columbia College, New York).

Chili: Rehm, Ascomyceten No. 1326b (two specimens in Bot. Dept. Herb. at Harvard Univ., one seen, both alike acc. Farlow; the specimen in Herb. C. E. Fairman, Lyndonville, N. Y., is *C. tropica*).

Columbia: Fitzpatrick Herb. No. 1484 (material found in phanerogamic herbarium at Harvard Univ. by A. J. Eames on leaves of *Podocarpus* sp. collected by Purdie).

Bolivia: Fitzpatrick Herb. No. 1577 (material communicated by L. Romell, of Riksmuseets Vetenskapsakademien, Stockholm, Sweden, from Herb. Robt. Fries No. 301 on *Podocarpus angustifolia;* part of the type material on which Starbäck founded *C oreöphila*).

Costa Rica: U. S. D. A. Bur. Pl. Ind. Herb. (material found in phanerogamic herbarium of U. S. National Museum by Miss Vera K. Charles on leaves of *P. macrostachys* No. 940952, collected at Volcan Poas, San Jose, by O. L. Jamenez).

7. **Corynelia brasiliensis** sp. nov.

TYPE: Material in herbarium of Elam Bartholomew at Stockton, Kansas, collected by F. Noack in the province of Sao Paulo, San Francisco dos Campos, Brazil, Dec. 1896, communicated by P. Sydow under the name *Corynelia oreophila* (Speg.) Starb. Slides showing asci and spores deposited in Fitzpatrick herbarium as No. 1630.

(Figures 4, 5)

Stromata scattered, circular to slightly elongated, sometimes erumpent before the delimitation of the perithecia, black, minutely roughened, amphigenous (chiefly hypophyllous) and caulicolous, not yet observed to be fructicolous, bearing 5–20 perithecia; perithecia approximately 1 mm. in length, in some cases crowded and covering the whole stroma, in others developed only at the margin of the stroma and radiating, the individual perithecia lying almost parallel to the surface of the leaf; the lower half of the mature perithecium subcylindrical, roughened like the stroma, and resembling closely the basal half of the perithecium of *C. oreophila;* the upper half, however, compressed laterally and definitely and broadly wedge-shaped; dehiscence occurring along the sharp edge of the wedge, the opposite faces of the wedge pulling apart and recurving, exposing the lighter colored inner surface of the perithetical wall; asci resembling those of *C. oreophila,* 8-spored; spores 10–12μ in diameter.

Parasitic on unidentified species of *Podocarpus* in Brazil.

In general appearance this species differs considerably from any other in the family on account of the wedge-shaped apex of the perithecium. The stroma and basal half of the perithecium are, however, very similar to the corresponding structures in *C. oreophila,* and a consideration of all the characters show these two species to be closely related. Both have typically 8-spored asci. Although the normal mature perithecia in the available material of *C. brasiliensis* have the characteristic wedge-shaped apex, occasional small, atypical and apparently stunted perithecia developed on the same stromata are of a different form. Such perithecia occasionally show the trilobed apex typical of *C. oreophila* or the bilobed apex more common in *C. portoricensis.* This condition may perhaps be explained as reversion to an ancestral type. A theoretical consideration of this point is given in the introduction to this paper. In the specimens examined there are several hundred typical full-sized perithecia with wedge-shaped apices and a relatively insignificant number of atypical individuals. No few-spored asci have been observed.

MATERIAL EXAMINED

Brazil: Specimen in harbarium Elam Bartholomew at Stockton, Kansas; collected by F. Noack in the province of Sao Paulo, San Francisco dos Campos, Brazil, Dec. 1896, communicated by Sydow under the name *Corynelia oreophila* (Speg.) Starb.; two specimens of same collection in herbarium H. Rehm at Stockholm, Sweden; slides showing asci and spores deposited in Fitzpatrick herbarium as No. 1630; Herb. H. Rehm No. 1743, collected by Ule.

8. **Corynelia portoricensis** sp. nov.

Corynelia clavata var. *portoricensis* Stevens, Illinois Acad. Sci. Trans: **10**: 178–181. *fig. 5.* 1917.

ILLUSTRATIONS: Stevens l. c. *fig. 5.*

TYPE: in the herbarium of the University of Illinois, Porto Rican Fungi, No. 784. A portion of this specimen is deposited in Fitzpatrick herbarium as No. 1591.

(Figures 1–3, 42)

Stromata scattered, circular to elongated, often erumpent before the delimination of the perithecia, subcarbonaceous, the interior homogeneous and black, the surface black and rough, amphigenous (chiefly hypophyllous, a single stroma sometimes erumpent on both surfaces of the leaf), caulicolous and fructicolous, bearing approximately 1–30 (averaging 11) perithecia; perithecia large, reaching 1.5 mm. in length, young and old periithecia frequently occurring on the same stroma, the younger ones usually at the center and the maturer ones at the margin, the marginal individuals usually radiating and often lying almost parallel to the surface of the host; young perithecia conical to short cylindrical, the apex smooth, rounded, and practically undifferentiated, the ascigerous cavity partially buried and pure white within; mature perithecia of two types, the first with trilobed apices, the second with bilobed apices; the trilobed individuals greatly resembling in form and size the typical perithecia of *C. oreophila*, occurring usually in the center of the stroma, and relatively few in number (11%); the bilobed individuals considerably flattened laterally in the upper half, measuring approximately 0.5 × 0.25 mm. in lateral diameter, and so characteristic in shape that this species can be easily recognized

with a hand lens; the lower part of the perithecium subcylindrical and roughened like the stroma, the upper part much smoother, minutely verrucose, dull to shiny; the apex of the trilobed individuals, subtruncate, umbilicate, and triangular as in *C. oreophila*, that of bilobed individuals rounded, not angular, slightly swollen above and tapering gradually below, traversed by a prominent suture which crosses the apex and runs down the two broader sides of the flattened upper half of the perithecium to the upper limit of the roughened lower half, or in some cases extending practically to the base of the perithecium; the bilobed perithecium sometimes also encircled in the narrowed central portion by several indistinct transverse wrinkles which give it an ungulate appearnace; dehiscence of the trilobed individuals as in *C. oreophila*, the upper half of the perithecium becoming deeply tri-cleft; dehiscence of the bilobed individuals taking place along the entire length of the furrow, the two halves of the perithecium pulling apart and turning back, exposing the interior of the ascigerous cavity and the lighter colored inner surface of the perithecial wall; asci not differing in the bilobed and trilobed perithecia, clavate to ovate, $14–25 \times 25–50\,\mu$ (p. sp.), typically (80%) 3-spored, the spores borne in a single row or forming a triangular group, approximately 15% of the asci 2-spored, asci containing a larger number of spores uncommon, 1-spored asci occasionally found, one ascus containing one normal spore and seven minute, elongated, flattened and probably non-functional spores seen (Figure 42), but an ascus containing eight normal spores not observed; spores $10.5–16.5\,\mu$ in diameter (usually $12–13.5\,\mu$, imperfectly formed spores more minute, and usually elongated and flattened.

Parasitic on *Podocarpus coriacea* near Maricao, Porto Rico. Not known on other hosts, or from other localities.

In general appearance this species differs markedly from any other in the family on account of the bilobed perithecia. The characters of the asci and spores are practically identical with those of *C. jamaicensis*. In *C. jamaicensis*, however, the perithecium is typically trilobed, occasionally quadrilobed, very rarely pentilobed, but in no case yet observed bilobed. In *C. portoricensis* it is typically bilobed, occasionally trilobed (11 per cent. of the cases), but in no case yet observed quadrilobed. *C. oreophila* and *C. brasiliensis* differ from *C. portoricensis* both in having typically 8-spored asci and in the form of their perithecia.

Since these species are all closely related, the examination of abundant material was desirable as having a bearing on the question of their possible inclusion in a single species. In *C. portoricensis* plenty of material was available and a count of the 2-lobed and 3-lobed perithecia gave the following results. On 281 stromata examined there were 344 3-lobed perithecia in a total of 3025 individuals, or approximately 11 per cent. In other words a cluster of 10 perithecia contains on the average a single 3-lobed individual, the remainder being 2-lobed. Practically no variation from this percentage was obtained after the first 500 individuals were counted. Moreover on an average 11 perithecia are developed on a stroma although the limits are from 1 to 33. On only 1 of the 281 stromata examined were there more 3-lobed than 2-lobed perithecia. In this case the count was 7 to 4. On the other hand 1 stroma examined contained 33 2-lobed individuals to 1 3-lobed one, while stromata bearing as many as 20 2-lobed perithecia and no 3-lobed ones are frequent.

Corynelia portoricensis is described by Stevens (49) as *C. clavata* var. *portoricensis*. It is clearly much more closely related to *C. oreophila* than to *C. clavata* (*C. uberata*). The latter species is unknown from the Western Hemisphere.

MATERIAL EXAMINED

Porto Rico: Brooklyn Botanic Garden, New York Botanical Garden, Cornell University, Exploration of Porto Rico. No. 698 (material collected by H. H. Whetzel and E. W. Olive and deposited at the three above named institutions and at Harvard Univ.: that at Cornell University Pl. Path. herb. No. 9655, Fitzpatrick Herb. No. 1021 and Whetzel Herb. No. 698); New York Botanical Garden, Carnegie Institution of Washington, United States National Museum, West Indian Exploration 1913, No. 2462 (material collected by N. L. Britton, F. L. Stevens and W. E. Hess; specimen at N. Y. Botanical Garden studied, portion of it in Fitzpatrick Herb. No. 1194); Herbarium University of Illinois, Porto Rican Fungi No. 784 (*type*, part of it deposited as Fitzpatrick Herb. No. 1591).

9. **Corynelia jamaicensis** sp. nov.

Corynelia clavata (Linnaeus) Saccardo p.p. in Hennings, Hedw. 37: 281. 1898.

TYPE: Flora Jamaicensis No. 6629 (material collected Aug. 10, 1896 by Wm. Harris on *Podocarpus purdieana* near the hotel "Holly Mount" on Mount Diablo, Jamaica).

(Figures 6, 7)

Stromata scattered, usually circular to elliptical in outline. sometimes more elongated, 1.5–3 × 1.5–7 mm., subcarbonaceous, hypophyllous, not observed to be caulicolous or fructicolous, bearing 20–100 or more crowded perithecia; perithecia forming on the buried stroma and erumpent when small, or developing later on the raised stroma; young perithecium as in *C. oreophila;* mature perithecium, large, reaching 1.5 mm. in length, approximately 0.5 mm. in lateral diameter, usually trisulcate and trilobed as in *C. oreophila;* quadrilobed individuals more common than in that species, and pentilobed individuals occasionally found; bilobed individuals never observed; dehiscence taking place along all the furrows so that a quadrilobed individual after dehiscence has a four-pronged apex; asci clavate to ovate, 15–27 × 28–42 μ (p. sp.), typically (80%) 3-spored (the spores in a single row or arranged to form a triangle), approximately 15 per cent. of the asci 2-spored, asci containing a larger number of spores uncommon, an 8-spored ascus not observed; spores 11–15μ in diameter; imperfectly formed spores more minute and usually flattened.

Parasitic on *Podocarpus purdieana* in Jamaica and known only on this host from the type locality. To be expected in other islands of the West Indies and on the mainland of South and Central America.

In general appearance of stroma and perithecium resembling *C. oreophila.* Characters of asci and spores practically identical with those of *C. portoricensis,* the tendency toward 1-spored asci being perhaps slightly more pronounced in this species than in *C. portoricensis.*

MATERIAL EXAMINED

Jamaica: Flora Jamaicensis No. 6629 (*type* material from the herbarium of Wm. Harris in Jamaica communicated by S. F.

Ashby and deposited in Fitzpatrick Herb. as No. 1561, also material deposited in N. Y. Bot. Gard. Herb.).

DOUBTFUL OR EXCLUDED SPECIES

1. CORYNELIELLA CONSIMILIS Hariot & Karsten, Rev. Mycol. 12: 128. 1890

(Figure 46)

This species was founded on a single collection of material from the island of Mauritius, and the writer has been unable to find any record of its subsequent collection. It was made the type of a new genus, and the genus is still monotypic. The original description is brief, a stroma is not mentioned, and no statement is given concerning the nature of the substratum. The fungus is not described as parasitic.

Lindau (28) includes the genus in the Coryneliaceae and states that a stroma similar to that of species of *Corynelia* is present. In his characterization of the family Coryneliaceae he states, moreover, that all the species are parasitic on leaves.

Through the courtesy of Professor L. Mangin, the writer has been enabled to examine a portion of the type material of this species, and the following facts are of interest. The perithecia occur on the bark of an unidentified woody plant and a stroma is absent. The bark is covered by a thin, white, waxy layer, resembling a resinous excretion, and the prominent, large, black perithecia are partially imbedded in the bark beneath this. The perithecia are usually solitary, but two or more are sometimes found close together. The shape of the perithecium cannot be determined from the material, the tips of all the individuals available for examination having been crushed. They are perhaps flask-shaped as described, but the species should be collected again and this point either confirmed or disproved. A microcopic examination of the type material shows the asci and spores in good condition. The ascus is cylindrical and 8-spored. Filiform paraphyses are present in abundance. The ascospores, at first greenish, are later brown, uniseriate, oblique, 3-septate and ellipsoidal. There is no reason for believing that the species is parasitic.

The absence of a stroma, the cylindrical non-stipitate character of the ascus, the abundance of paraphyses, and the septation of the spores all indicate that *Coryneliella consimilis* is not closely related to the Coryneliaceae. Since nothing is known, however, concerning the dehiscence of the perithecium, the proper position of the species in classification cannot be given.

2. CORYNELIA POCULIFORMIS Kunze, in Weigelt Surinam Exsic. 1827

Hypoxylon (*Bacillaria*) *poculiforme* Montagne, Ann. Sci, Nat. Ser. 2. 13: 354. 1840.

Sphaeria poculiformis (Montagne) Léveillé, Ann. Sci. Nat. Ser. 3. 5: 257. 1846.

Leviellea poculiformis Fries, Summa. Veg. 409. 1849.

Phylacia poculiformis (Kunze) Montagne, Ann. Sci. Nat. Ser. 4. 3: 135 1855.

Winter (55) states that he has studied the type material of this species collected by Weigelt in Surinam, and finds that it is not a *Corynelia*. I have seen the figures given by Montagne (31) and the fungus figured is certainly not one of the Coryneliaceae.

3. HYPSOTHECA THUJINA Ellis and Everhart, Jour. Mycol. 1: 129. 1885. Also in North American Pyrenomycetes 199, 200. 1892

Ellis founded this species on material collected on *Chamaecyparis thyoides* at Newfield, New Jersey, and gives a detailed description of both the pycnidial and ascigerous stages. The fungus is evidently closely related to the other species described by him in the genus *Hysotheca*. The original collection of material has been lost, however, and in so far as the writer has been able to discover a second collection has never been made. The type material is not in the Ellis herbarium at the New York Botanical Garden, or in the set of Ellis types at Harvard University. A search for the species was recently made by Doctor E. W. Olive and the writer at Newfield, New Jersey, the type

locality, but, although the host was extremely abundant, the fungus was not found. In 1918 Doctor Olive and Professor H. H. Whetzel searched for the fungus at Lakehurst, New Jersey, but failed to find it. Since the writer has seen no material, it seems best to omit the species from the present monograph. If incorporated here it would probably bear the name **Caliciopsis thujina** (E. & E.) comb. nov.

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PENICILLIUM SPICULISPORUM, A NEW ASCOGENOUS FUNGUS

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(With Plate 19)

The organism herein described first appeared in cultures from rootlets of apparently healthy cotton plants taken from a field in Anson County, N. C. In making the original cultures short pieces of rootlets were first washed, then treated with 50 per cent. solution of alcohol, rinsed in sterile water and placed into tubes of steamed rice. Some three or four weeks later the original cultures were observed to contain a fungus which had formed great numbers of perithecia of the type belonging to the Aspergillaceae. When ascospores from these perithecia were planted in potato glucose agar in petri dishes, white spreading colonies developed producing, first, a sparse crop of penicillate conidial fructifications and later, perithecia identical with those in the original cultures. The structure of the condial fructifications places this fungus definitely in the genus *Penicillium,* and a comparison of its morphological and cultural characters with those of other species of this genus as given in descriptions published by Saccardo (1), Lafar (2), Engler and Prantl (3), Thom (4), Sopp (5), Sartory (6) and Sartory and Bainier (7–10) shows it to differ from any of these in one or more important features. It is, therefore, described as a new species and since the walls of the ascopores bear minute spines, it is designated **Penicillium spiculisporum.**

Work with this fungus has shown that perithecia are produced in abundance on a wide variety of media without special cultural methods, a character rendering improbable the assumption that anyone could have cultivated this fungus without having observed them. This habit of abundant and continued perithecial formation coupled with sparse conidial production, a character not at all usual to species of *Penicillium,* is possessed in common

by *P. luteum* Zukal (11), *P. avellaneum* Thom and Turreson (12) and the species herein described. Its morphology, the production of transient yellow color in limited areas on certain media, and the general production of yellow associated with perithecia on potato plugs seem to place *P. spiculisporum* in the luteum-purpurogenum series as defined by Thom (1).

DESCRIPTION OF THE ORGANISM

Conidia sown on potato or bean agar and kept at 28° C. germinate in great numbers within ten hours by first swelling, then putting out one to three tubes (Fig. 18). These hyphae rapidly branch, and, by the end of 48 hours, form a growth easily visible to the eye. From these centers low spreading colonies develop with white floccose surface consisting of aerial mycelium bearing a sparse crop of conidiophores as short lateral branches. The mycelium is hyaline, septate, branched, often forked at the apex, 2–3.5 μ in diameter (Fig. 1–3). Numerous perithecial initials may appear within two weeks, giving the surface a granular appearance. White is the predominating surface color, but this may change to cream, yellow or pinkish as the perithecia mature. The yellow color is often transient, fading again to white or cream. Infrequently in tube cultures, portions of the surface are made to appear gray by a profuse development of conidia.

Conidiophores are short, 10–50 μ by 2–2.5 μ, usually 14–20 μ long, and bear a single verticel of three to five conidiiferous cells (Figs. 9–12). Occasionally there are only one or two or as many as six conidiiferous cells in a verticel (Fig. 5–8). Frequently the conidiophore produces a side branch bearing a single chain of conidia (Fig. 13) or, less frequently, it may carry at its summit two metulae each of which bear verticels of three to five conidiiferous cells (Fig. 14). If the conidial fructification occupies the end of an aërial hypha, the conidiiferous cells may be loosely disposed over a distance of 40–50 μ back from the apex (Fig. 15).

Conidiiferous cells are 11–16 μ long by 1.8–2.5 μ in diameter at the thickest part, the distal third of each cell tapering to a

sterigma of half this diameter (Fig. 7–9). Conidial chains may attain a length of 85 μ, easily break apart in water mounts and do not form columns. Conidia are ovate, elliptical or globose, 2.5–4 μ by 1.8–2.5 μ in six-day old drop cultures, have smooth walls and appear hyaline under the microscope (Fig. 16, 17). However, when they form in profusion, as infrequently happens in small areas, the surface appears gray with a faintly perceptible shade of green or brown according to the density of the growth. They swell and produce one to three tubes in germination.

If cultures on steamed rice and potato plugs in tubes, or on potato- and bean-glucose agar in petri dishes, are kept at 35 degrees Centigrade, great numbers of perithecia will be found developing at the end of two weeks. If crushed mounts are made at the end of 20 days, great numbers of asci and ascospores may be found in all stages of development. Perithecia are at first white, and may remain so; but, within thirty days, the color may have changed so that white, cream, pink and yellow shades may appear, all of which may be present in the same culture. The yellow is often transitory, fading again to cream or white.

Perithecial formation begins with the twisting together of the ends of two or more hyphae to form a knot (Fig. 19). Other hyphae grow out from and weave around this knot, gradually enlarging it and forming a white hyphal gnarl. When this gnarl has nearly attained mature size, the cells of the hyphal branches within swell and are transformed to asci (Fig. 23–28). When this process of development is complete, the perithecial cavity is found to be closely packed with ascospores, the delicate ascus walls and all hyphae having entirely disappeared. Perithecia are spherical, except when crowded, 0.4–2 mm. (mostly 0–5.1 mm.), indehiscent, with a peridium consisting of three parts: a thin inner layer of closely woven hyphae, a thick middle layer of loosely woven threads, and a very narrow outer layer (Fig. 20–22). The hyphae constituting the middle layer and the outermost layer of the peridium are of less diameter than those composing the innermost layer and the ascogenous center.

Asci are globose, elliptical, or pyriform, 7.2–10.8 by 6.3–7.7 μ, hyaline, 6–8-spored, the walls disappearing as the spores mature

(Fig. 30–34). Ascospores are ovate to elliptical, 2.5–4 μ by 1.8–2.8 μ, with walls bearing minute spines (Fig. 35). The spines are visible only under oil immersion, and then to best advantage when the spores have been treated three to five minutes with alcohol carbol fuchsin as if staining bacteria. Only about one per cent. of the ascospores have germinated on any of the various media used. Fig. 37 represents a colony grown from a single ascospore on beef peptone agar kept at 28° C. for 48 hours. At 72 hours, this colony had attained a diameter of 675 μ and had developed a few conidiophores with chains of six to ten spores.

Penicillium spiculisporum sp. nov.

Coloniis in agaro Solani tuberosi vel Phaseoli cultis, albis, rare instabiliter sulphureis, floccosis, extendentibus incerte; reverso albo aut cremeo. Conidiophoris sparis, ex hyphis aereis orientibus, 10–50 μ × 2–2.5 μ, usitate unum verticillum 1–6 basidiorum vel rare 1–2 metulorum vel basidiorum et metulorum gerentibus; basidiis 11–16 μ × 1.8–2.5 μ, contractis ad apices; conidiis ovatis, ellipticis vel globosis, hyalinis vel pallide glaucis in massa, 2.5–4 μ × 1.8–2.5 μ, levibus. Peritheciis abundantibus, globosis, primo albis, diende cremeis vel sulphureis, citrinis, flavis vel luteis, 0.4–2 mm., nondehiscentibus, peridiis non parenchymaticis, ex tribus ordinibus hyphorum, compositis; ascis globosis, ellipticis vel pyriformis, 7.2–10.8 μ × 6.3–7.7 μ, hyalinis, 6–8 sporis; ascosporis ovatis, ellipticis, hyalinis, spinulosis, 2.5–4 μ × 1.8–2.8 μ. Coloniis gelatinam nonliquifacientibus. Odore nullo. Aeris temperatione optima 33–35° C. Culturae ex Gossypio herbacearo Anson Co., N. C., U. S. A.

CULTURAL CHARACTERS

Potato agar, good growth, spreading colonies with low, white, floccose surface; glucose or saccharose added, vigorous growth, many perithecia formed; surface white or transiently yellow, reverse white to cream.

Potato plugs, vigorous growth soon forming a dense mat of white mycelium, and, later, numerous white, cream and yellow perithecia.

Bean agar, same as for potato agar but somewhat less vigorous.

Beef peptone agar, colonies remain small, surface velvety with conidial fructifications arising from immersed hyphae.

Steamed rice, good growth, numerous white, cream, pinkish or yellow perithecia within 30 days.

Fifteen per cent. gelatin, sparse growth, not liquidified in 30 days at 28° C.

Milk, very little, if any, growth.

Czapeck's solution agar (nitrogen omitted) to which the following substances were added:

Saccharose 3 per cent., poor growth, no perithecia.

Glucose, 3 per cent., poor growth, no perithecia.

Maltose, 3 per cent., good growth, many sulphur colored perithecia at 14 days, reverse faint cream.

Lactose, 3 per cent., very poor growth, no perithecia.

Galactose, 3 per cent., good growth of rapidly spreading colonies, few sulphur colored perithecia at 14 days.

Glycerin, 3 per cent., good growth, many cream-colored perithecia at 14 days, reverse white and cream.

Armour's peptone, 3 per cent., poor growth, no perithecia, reverse cream.

Armour's peptone, 3 per cent., and saccharose, 3 per cent., vigorous growth forming a dense mat of mycelium, few perithecia, surface floccose and gray with conidial fructifications, reverse dark cream.

Asparagin, poor growth, saccharose added, very good growth, many small perithecia.

Urea, no growth.

Potato starch, fairly good growth, many small perithecia, colonies surrounded by a wide circle of clear media from which the starch has been dissolved by an enzyme.

Butterfat, very poor growth.

Temperature relation: On bean- or potato-saccharose agar growth is slow at 20° C., good at 28, optimum at 33–35, good at 40.

Color: White is the predominating surface color; however, when conidia form in profusion, as infrequently accurs in small areas, or over the entire surface when certain substances are

added to the substratum, the surface appears gray with faint shades of green and brown. Other pigments are associated with the perithecia. These bodies are at first white, and may remain so indefinitely, but very often they become cream, pinkish or some shade of yellow. All these colors may be present in a single tube of steamed rice. The yellow varies in shade from sulphur through lemon-yellow to yellow and may deepen to golden-yellow in our cultures (13). Yellow is often transitory and erratic coming on comparatively few, if any, perithecia of a given rice culture, and usually fading to cream or white within a week or infrequently deepening to golden yellow. On potato plugs yellow is less transitory and more certain to develop. The reverse of petri dish cultures is often cream in color and pink is frequently seen in small mycelial areas in rice tubes.

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EXPLANATION OF PLATE 19

All drawings were outlined and as many as possible of the details put in with the aid of the camera ludica. The reduced magnification can easily be calculated from the scale given with each group.

Figs. 1–3. Hyphae showing nature of contents, septation and manner of branching.

Fig. 4. Sketch of fructifications.

Figs. 5–15. Conidiophores showing various types of fructifications found in potato glucose agar plates.

Fig. 16. Conidia grown in starch agar plate. Drawing made from water mount.

Fig. 17. Conidia grown on potato glucose agar. Drawing made from material stained with alcoholic carbol fuchsin and mounted in balsam.

Fig. 18. Conidial germination in a 20-hour old potato glucose agar culture at 28° C.

Fig. 19. Beginning stages in perithecial development.

Fig. 20. Microtome section of a cluster of perithecia grown on steamed rice. The letter "*a*" locates the inner, "*b*" the middle and "*c*" the outer layers of the peridium.

Fig. 21. Microtome section of small perithecia grown on potato glucose agar in petri dish.

Fig. 22. The portion marked "*x*" of Fig. 21 much more highly magnified. Note the character of the peridium and the clusters of ascospores among the fertile hyphae.

Fig. 23. Swollen hyphae from the center of a young perithecium.

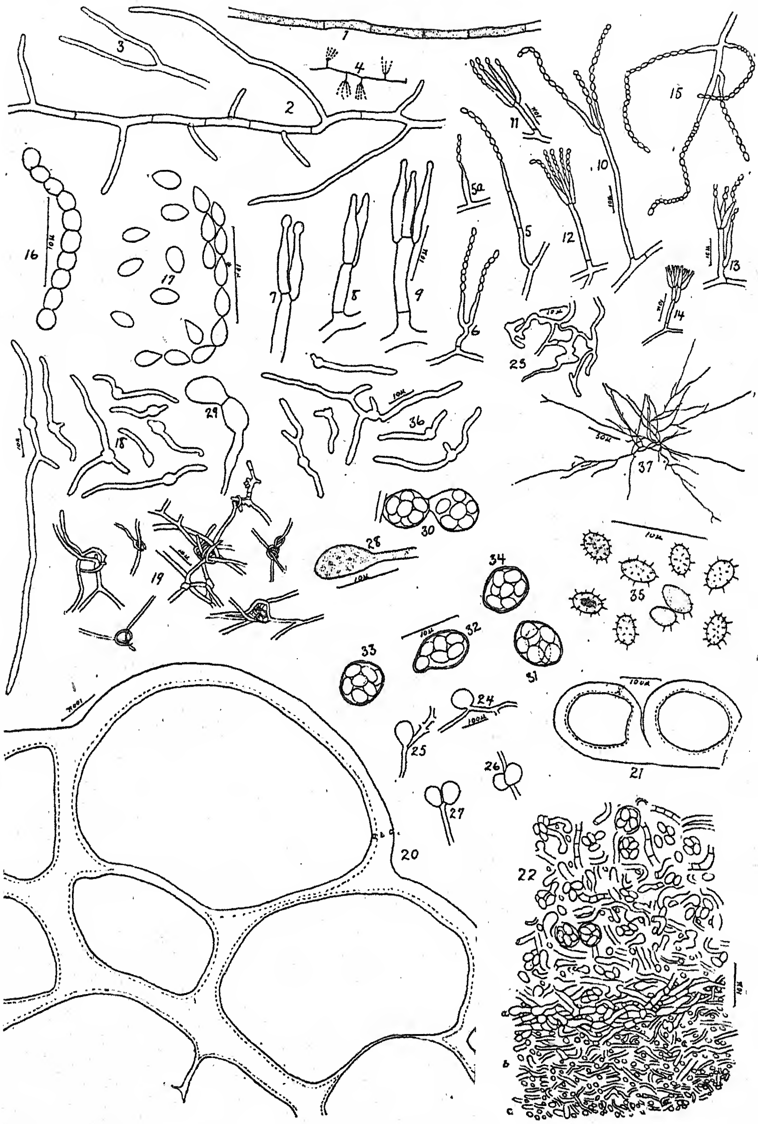
Figs. 24–29. Asci and hyphal attachments.

Figs. 30–34. Asci containing ascospores.

Fig. 35. Ascospores highly magnified. Note the spines on the walls. Drawing made from spores stained with alcoholic carbol fuchsin and mounted in balsam.

Fig. 36. Ascospores germinating in a 24-hour old culture of beef peptone agar kept at 28° C.

Fig. 37. Camera lucida sketch of 48-hour old colony on beef petone agar. This colony grew from an ascospore.



PENICILLUM SPICULISPORUM LEHMAN

SOME USTILAGINEAE OF THE STATE OF WASHINGTON

George L. Zundel

Introductory Statement

No special effort has previously been made to list the Ustilagineae of Washington. Scattered through literature, however, there are a fairly large number of reports of smuts from Washington. It would be hard to find another state where more ideal conditions for mycological study exist, especially for the study of smuts and rusts. The state has an area of 69,180 square miles and a coast line of 1,860 miles, together with a varied topography and a climate ranging from one warm enough to raise figs to that of a very frigid character, and a variation of rainfall from less than 5 inches to over 130 inches, the fungous flora of the state is naturally varied.

Of the botanical collectors who have worked in the state a large proportion have found smuts. Among them are W. N. Suksdorf, David Griffitffihs, T. E. Wilcox, E. R. Lake and W. R. Hull, J. S. Cotton, R. M. Horner, C. V. Piper, R. K. Beattie. For the last five years the Plant Disease Survey of Washington, under the direction of Dr. F. D. Heald, has added to the smut collections of the state. Mr. W. N. Suksdorf has, perhaps, contributed most to our knowledge of Washington smuts. His collecting has been confined, however, to small areas, in Klickitat and in Skamania Counties, so that there are still counties in the state from which not a single smut has been reported. Mr. Suksdorf has also collected on Mt. Adams (Mt. Paddo, used by Suksdorf, is the old Indian name for Mt. Adams).

Source of Material

The smuts reported in this list represent material from a number of sources.

(*a*) References taken from literature but no specimens examined.

(*b*) Specimens examined from various herbaria.

(*c*) Specimens sent to the author mostly by W. N. Suksdorf.

(*d*) Material in the herbaria of the department of botany and of the department of plant pathology of the State College of Washington. A number of these collections were found by reference to the "Parasitic Fungi of the Northwest" by Martin, now in process of publication.

(*e*) The author's own collection. Where no credit is given it is the author's own collection.

The writer has used the nomenclature of Clinton as it appears in North American Flora.

LIST OF SPECIES

Arranged alphabetically for Genus, Species, and Host.

CINTRACTIA CARICIS (Pers.) Mag. Abh. Bot. Ver. Prov. Brand., **37**: 79. 1896.

On *Carex geyeri*, Mt. Adams (Mt. Paddo), Wash. Sept. 21, 1899 (W. N. Suksdorf, No. 554).

On *Carex* sp., Mt. Adams (Mt. Paddo), Wash. Aug. 11, 1885 (W. N. Suksdorf, No. 188).

CINTRACTIA SEYMORIANA Mag.

On *Panicum crus-galli*, Bingen, Klickitat Co., Wash. Oct. 3, 1894 (W. N. Suksdorf, No. 404). This name is now considered as a synonym of *Ustilago crus-galli*.

DOASSANSIA ALISMATIS (Nees) Cornu. Ann. Sci. Nat. VI. **15**: 285. 1883.

On *Alisma plantago*, Columbia River, W. Klickitat Co., Wash. May 23, 1884 (W. N. Suksdorf No. 165 as per letter of Jan. 13, 1920, from Dr. G. P. Clinton); Pullman, Whitman Co., Wash. Aug. 20, 1894 (Piper, No. 278, W. S. C. Herbarium).

DOASSANSIA MARTIANOFFIANA (Thüm) Schrot. Krypt. Fl. Schles., 3: 287. 1887.

On *Potamogeton gramineus*, Falcon Valley, Klickitat Co., Wash. Aug. 1885 (W. N. Suksdorf No. 205 as per letter from Dr. G. P. Clinton of Jan. 13, 1920).

ENTYLOMA ARNICALE El. & Ev. Bull. Torr. Bot. Club, **22**: 57. 1895.

Type collected in Skamania County, Wash.—on leaves of *Arnica chamissonis*, 1891. Other collections on leaves of *Arnica cordifolia*, Latah County, Idaho, July 1893 (C. V. Piper No. 122).

ENTYLOMA COMPOSITARUM Farl. Bot. Gaz., **8**: 275. 1883.

On *Amsinkia intermedia*, Waitsburg, Walla Walla Co., Wash. May 28, 1900 (Horner, No. 1468—W. S. C. Herbarium).

On *Erigeron elatus* and *E. solsuginosus* (North American Flora, **7**: pt. 1, p. 62).

SPACELOTHECA REILIANA (Kühn) Clint. Jour. Myc., **8**: 141. 1902.

On *Zea mays*—20 acre patch north of Wash. State College, Pullman,

Whitman County, Wash.—40 per cent. infection mostly in tassel, Sept. 12, 1919 (Zundel and Williams). On Wash. State College Farm, Oct. 1919 (Dana).

SPACELOTHECA SORGHI (Link) Clint. Jour. Myc., **8**: 140. 1902.

On *Sorghum* sp. (cultivated), Forage nursery Washington State College, Pullman, Whitman Co., Wash. Sept. 10, 1915 (Heald and George C. S. No. 238); Yakima, Yakima Co., Wash. Oct. 10, 1918 (E. C. Scott, I. S. No. 1708); near Chelan, Chelan Co., Wash. Summer 1918.

TILLETIA ASPERIFOLIA El. & Ev. Jour. Myc., **3**: 55. 1887.

On *Sporobolus asperifolius,* Rockland, Klickitat Co., Wash. June 3, 1905 (W. N. Suksdorf No. 998); Yakima, Yakima Co., Wash. Aug. 1895 (Watt, W. S. C. Herbarium).

TILLETIA ELYMI Diet. & Hol. Bot. Gaz., **19**: 305. 1894.

On *Elymus* sp., Skamania Co., Wash. Aug. 13, 1886. Type collection (W. N. Suksdorf No. 336).

TILLETIA FOETENS (B. & C.) Trel. Par. Fungi. Wis. 35. 1884.

Collected on *Triticum* sp.—in Thurston Co., Grays Harbor Co., Island Co., and Lincoln Co., Wash. Summers of 1918–1919. The one sample from Lincoln County in 1919 is the only one known to have been collected in Washington, east of the Cascade Mountains.

TILLETIA FUSCA El. & Ev. P. B. I. Bull., **38**: 43. 1903; Jour. Myc., **3**: 55. 1887.

On *Festuca microstachys* and *F. octaflora,* 25 miles north of Prosser, Benton Co., Wash. Summer 1903 (David Griffiths). Fully three-fourths of all plants had been destroyed by the smut; Rattlesnake Mountains, Yakima Co., Wash. June 18, 1901 (J. S. Cotton in Flora of Yakima Region, 1901).

TILLETIA GUYOTIANA Har. Jour de Botanique, **1900**: 117. 1900.

Syn. *Thecophora guyotiana* Har. Mem. Soc. Acad. de l'Aube, **1887**: 195. 1887.

Sori replacing ovaries, somewhat flexible. Spores enmasse reddish-brown, spores yellowish, clear, globose, roughly elliptical, very elegantly reticulated, 19–25 μ diam.

On *Bromus hordaceus glabrescens,*

(*a*) Wedgewood Bros. Farm, Goldendale, Klickitat Co., Wash. Aug. 12, 1919 (Zundel & Cooney). Elevation 2200 ft.

(*b*) Three miles west of Goldendale, Klickitat Co., Wash. Aug. 12, 1919. Elevation 1900 ft.

(*c*) South end of Trout Lake, Klickitat Co., Wash. Aug. 13, 1919.

(*d*) White Salmon, Klickitat Co., Wash. Aug. 13, 1919.

(*e*) Staker's Canyon, Klickitat Co., Wash. Aug. 14, 1919.

(*f*) Seven miles east of Dixie, Walla Walla Co., on the foothills of the Blue Mountains. Sept. 28, 1919 (Zundel & Patton).

So far as the writer has been able to ascertain this is the first time that this smut has been reported from North America. Plants were found that were smutted with both *Ustilago bromivora* and *Tilletia guyotiana.* It is very abundant on the foothills of the Blue Mountains of Washington and all over Klickitat County, Wash. It is very inconspicuous and not easily found unless one knows exactly what to look for. The writer first found his specimen

when opening a gate for County Agent Cooney of Klickitat Co., when going into a wheat field. A piece of brome grass was picked and the kernel smashed. A dark dusty mass fell into his hand and a careful examination resulted in the finding of this smut.

TILLETIA RAUWENHOFFII Fisch. de Wald. Aperçu, p. 50.

Syn. *Tilletia holci* (West) Rost. Danish Fungi by J. Lind., 1913: 266. 1913.

Sori irregular, in ovary of host, dark, spores reticulate, in two layers. An inner layer olive brown, an outer layer visible on the periphery of the spores, hyaline, side hexagonal, not very prominent hexagonal reticulations. Spores 22–30 μ diam.

On *Holcus lanatus*, Kelso, Cowlitz Co., Wash. Aug. 6, 1919.

Five collections at Kelso, Wash. Aug. 17, 1919. Not very abundant. This smut has previously been reported from Belgium and Denmark. So far as the writer is aware this is the first report of this smut from North America.

TILLETIA TRITICI (Bjerk.) Wint. Rab. Krypt. Fl., 1^1: 110. 1881.

On kernels of wheat, Bingen, Klickitat Co., Wash. Aug. 3, 1902 (W. N. Suksdorf No. 996).

Found on *Triticum* spp.—in every county of Washington. Most abundant in the Palouse region of eastern Washington. Causes an annual loss in the state of about $5,000,000.00.

USTILAGO AVENAE (Pers.) Jens. Charb. Céréales, 4. 1889.

On *Avena sativa*, Prevalent west of Cascade Mountains, rarely found east of the Cascade Mountains.

USTILAGO BISTORTORUM (DC.) Körn. Hedwigia, 16: 38. 1877.

On *Polygonum* sp., Mt. Adams (Mt. Paddo), Wash. Aug. 7, 1885 (W. N. Suksdorf No. 198).

USTILAGO BROMIVORA (Tul.) Fisch. de Wald.—Bull. Soc. Nat. Mosc., 40: 252. 1867.

On *Bromus eximius*, West of Ice Cave, Skamania Co., Wash. Sept. 9, 1902 (W. N. Suksdorf No. 1021).

On *Bromus hookerianus*, on banks of Columbia River, Klickitat Co., Wash. June 1883 (W. N. Suksdorf No. 66).

On *Bromus hordaceus*, Wawawai, Whitman Co., Wash. May 7, 1915 (George, W. S. C. Path. No. C. S. 26); Pullman, Whitman Co., Wash. July 1, 1915 (G. A. Olson, W. S. C. Path. No. C. S. 130); July 10, 1916 (Dana, W. S. C. Path. No. C. S. 360).

On *Bromus hordaceus glabrescens*, Coupeville, Island Co., Wash June 19, 1919; White Salmon, Klickitat Co., Wash. Aug. 13, 1919.

On *Bromus marginatus*, Aug. 18, 1904. Wentachee Mts., Chelan County, Wash. (Cotton—W. S. C. Herbarium).

On *Bromus* sp., Colfax, Whitman Co., Wash. July 19, 1919; Rosalia, Whitman Co., Wash. Aug. 1, 1919.

On *Bromus* sp., Washington State College Campus, Pullman, Whitman Co., Wash. July 2, 1918 (W. S. C. Path. C. S. No. 516) also July 1919; Puyallup, Pierce Co., Wash. July 16, 1919; Maryhill, Klickitat Co., Wash. Aug. 12, 1919; Stacker's Canyon, Klickitat Co., Wash. Aug. 14, 1919; LaConner, Skagit Co., Wash. Aug., 1919.

USTILAGO BROMIVORA MACROSPORA Farl. Bull. Iowa Agr. Coll. Bull. Bot. Dep., **1886**: 59. 1887.

On *Bromus tectorum*, Chelan Lake, Chelan Co., Wash. Aug. 27, 1916 (Weir No. 12496).

USTILAGO CLAYTONIAE C. L. Shear. Bull. Torr. Bot. Club, **34**: 317. 1907.

Type collected by Colonel T. E. Wilcox on *Claytonia linearis* Dougl. Vancouver Barracks, Vancouver, Clarke Co., Wash. Apr. 8, 1903; Campus Wash. State College, Pullman, Whitman Co., Wash. May 14, 1920 (Sullins & Zundel).

USTILAGO CRUS-GALLI. Tr. & Ear. Bull. Tor. Bot. Club, **22**: 175. 1895.

On *Panicum crus-galli*, Western Klickitat Co., Wash. (W. N. Suksdorf No. 3677, Specimen in herbarium of Dr. Jas. Weir, Spokane, Wash.).

On *Panicum milaceum* (Broom corn millet), Sunnyside, Yakima County, Wash. Oct. 19, 1915 (Heald & George No. I. S. 458).

USTILAGO ECHINATA Schröt. Abh. Schles. Ges. Abth. Nat. Med., **1869–72**: 4. 1870.

On leaves of *Phalaris arundinaceae*, collected on bottom land—Bingèn, Klickitat Co., Wash. June 30, 1893 (W. N. Suksdorf No. 413).

USTILAGO HORDEI (Pers.) Kel. & Sw. Ann. Rep. Kans. Agr. Exp. Sta., **2**: 268. 1890.

On *Hordeum* spp. Throughout the state of Washington.

USTILAGO HYPODYTES (Schl.) Fr. B. P. I. Bull., **38**: 43. 1903. Syst. Myc., **3**: 518. 1832.

On *Distichlis spicata* (North Amer. Flora, **7**: 5. 1906).

On *Elymus condensatus*, Okanogan, Wash. Summer, 1903 (David Griffiths).

On *Eriocoma cuspidata*, on Big Bend Land Co., Northern Franklin Co., Wash. Aug., 1919. From material sent to Dr. F. L. Pickett, of the Washington State College Botany Department; Pasco, Franklin Co., Wash. April 21, 1920, on year old stalks of the grass.

On *Sitanion* sp., Mt. Adams (called by Indians Mt. Paddo), Wash. Sept. 30, 1904 (W. N. Suksdorf No. 980); Wenatchee, Chelan County, Wash. July 17, 1919 (Leonard).

On *Stipa* sp., Falcon Valley, Klickitat Co., Wash. July 10, 1900 (W. N. Suksdorf, No. 606*a*), Aug. 26, 1904 (W. N. Suksdorf No. 606*b*).

USTILAGO LEVIS (Kel. & Sw.) Magn. Abh. Bot. Ver. Prov. Brand., **37**: 69. 1896.

On *Avena fatua glabrata*, Oakesdale, Whitman County, Wash. July 29, 1919 (J. W. Hotson).

On *Avena* sp., Bingen, Klickitat Co., Wash. July 13, 1902 (W. N. Suksdorf No. 805).

This smut of oats is prevalent east of the Cascade Mountains. It is also found in western Washington (See Heald, F. D., "Oat Smuts in Washington" in Proc. Wash. State Grain Growers, Shippers and Millers Association, **1919**: 29).

USTILAGO MUFORDIANA El. & Ev. Bull. Torr. Bot. Club, **22**: 362. 1895.

On *Festuca microstschys* (?) or *F. reflexa* (?), Bingen, Klickitat Co., Wash. July 3, 1902 (W. N. Suksdorf No. 804).

On *Festuca tenella*, Bottom land of the Columbia River at Bingen, Klickitat Co., Wash. May 26, 1896 (W. N. Suksdorf No. 555).

USTILAGO NUDA (Jens.) Kel. & Sw. Ann. Rep. Kans. Agr. Exp. Sta., **2**: 277. 1890.

On *Hordeum* spp. (cultivated), Florence and Marysville, Snohomish Co., Wash. Summer 1919.

USTILAGO PERENNANS Rostr. Overs. K. Danske Vid. Selsk. Forh., **1890**: 15. March, 1890.

On *Arrhenatherum elatius* (escaped from cultivation and locally called Lincoln grass).

Wash. State College Farm, Whitman Co., Wash. May 1, 1919 (Wanser, W. S. C. Path. I. S. No. 1379); Trout Lake, Klickitat Co., Wash. Aug. 13, 1919.

USTILAGO PUNCTATA Clint. North Amer. Flora, **7**: 23–24. 1906.

On *Polygonum newberryi*, Mt. Adams (Indian name, Mt. Paddo), Wash. Sept. 6, 1904 (type collection, W. N. Suksdorf No. 979).

USTILAGO STRIAEFORMIS (Westend.) Niessl. Hedwegia, **15**: 1. 1876.

On *Phleum pratense*, Bingen, Klickitat Co., Wash. May 21, 1896 (W. N. Suksdorf No. 532); Pullman, Whitman Co., Wash. June 21, 1916 (Heald, W. S. C. Path. No. I. S. 285); Oakesdale, Whitman Co., Wash. June 13, 1919 (C. R. Stillinger in Jas. Weir Herb., Spokane, Wash.); Washington State College Campus, east of Silver Lake, Pullman, Whitman Co., Wash. Summer 1919; Waterville, Douglas Co., Wash. June 23, 1919.

On *Poa pratense*, Washington State College Campus, East of Silver Lake, Pullman, Whitman Co., Wash. Summer 1919.

USTILAGO TRITICI (Pers.) Rostr. Overs. K. Danske Vid. Selsk. Forth, **1890**: 15. March, 1890.

On *Triticum* spp., throughout the state of Washington in amounts not exceeding 5 per cent.

USTILAGO URTICULOSA (Nees.) Tul. Ann. Sci. Nat. III., **7**: 102. 1847.

On *Polygonum hydropiperoides*, bottom land of the Columbia River, Bingen, Klickitat Co., Wash. Oct. 7, 1885 (W. N. Suksdorf No. 221).

USTILAGO VIOLACEAE var. *major* Clint. Jour. Myc., **8**: 139. 1902.

On *Silene* sp., Mt. Adams (Mt. Paddo), Wash. Oct. 1, 1904 (W. N. Suksdorf No. 983).

On *Alsine nitans*, Wash. State College Campus, Pullman, Whitman Co., Wash. May 14, 1920.

USTILAGO WASHINGTONIANA El. & Ev. Bull. Torr. Bot. Club, **22**: 57. 1895.

From collection by E. R. Lake, spring of 1892 on leaves of "some grass." The locality is not given in the article. Clinton considers this species as a synonym of *Ustilago striaeformis* (Westend) Niessl.

USTILAGO ZEAE (Beckm.) Unger, Einfl. Bodens 211. 1836.

On *Zea mays*, Walla Walla, Walla Walla Co., Wash. Aug. 16, 1915 (Heald, W. S. C. Path. No. C. S. 201); Sunnyside, Yakima Co., Wash. Oct. 19, 1915 (C. C. Farr, W. S. C. Path. I. S. No. 457); Pullman, Whitman Co, Wash. Aug. 29, 1916 (Heald, W. S. C. Path. No. C. S. 409); Oct. 5,

1916 (Heald, W. S. C. Path. C. S. 435); Pullman, Whitman Co., Wash. Jan. 1, 1918 (E. F. Gaines, W. S. C. Path. No. I. S. 1279); Walla Walla Co. and Yakima Co. Wash. Sept., 1918. Becoming somewhat prevalent in these two localities in the state. Prosser, Benton Co., Wash. July 8, 1919 (E. B. Starkey, W. S. C. Path. I. S. 2032).

UROCYSTIS AGROPYRI (Preuss) Schrot. Abh. Schles. Ges. Abth. Nat. Med., 1869–72: 7. 1870.

On "grass leaves," Bingen, Klickitat Co., Wash. May 3 and 28. 1899 (W. N. Sukslorf No. 464).

On *Bromus marginatus,* Port Townsend, Jefferson Co., Wash. Aug. 7, 1919 (Knight).

On *Elymus condensatus,* Isaacs St., Walla Walla, Walla Walla Co., Wash. June 17, 1919; La Conner Flats, Skagit Co., Wash. June 27, 1919.

UROCYSTIS GEI El. & Ev. Bull. Tor. Bot. Club, 27: 572. 1900.

On leaves of *Sieversia ciliata* (*Geum ciliata*), Waitsburg, Walla Walla County, Wash. May 7, 1900 (Robert M. Horner No. 1430) Clinton calls this species *Urocystis Waldsteiniae* Peck.

Besides the smuts reported in the preceding list, the following are reported as occurring in Washington. The author, however, has not been able to locate the collections from which these reports were made, viz.:

USTILAGO MACROSPORA Desmaz.

On *Agropyron spicatum inerme* (North Amer. Flora, 7: 19. 1906).

USTILAGO OLIVACEAE (D. C.) Tul.

On *Carex atriculata* (North Amer. Flora, 7: 12. 1906).

USTILAGO VINOSA (Berk) Tul.

On *Oxyria digyna* (North Amer. Flora, 7: 21. 1906).

TILLETIA AIRAE Blytt.

On *Deschampsia caespitosa* (North Amer. Flora, 7: 49. 1906).

THECAPHORA DEFORMANS Dur. and Mont.

On *Lotus micranthus* (North Amer. Flora, 7: 41–42. 1906).

DEPARTMENT OF PLANT PATHOLOGY,
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AN UNDESCRIBED GENEA FROM MICHIGAN[1]

E. A. Bessey and Bertha E. Thompson

(With Plate 20)

The known Tuberaceae from Michigan are few in number. In 1908 Dr. C. H. Kauffman[2] reported *Tuber lyoni* from near Ann Arbor and in 1911[3] he reported from Allegan County a species identified by him as *T. borchii,* and recently described by Miss Gilkey[4] as a new species *T. canaliculatum.* Aside from these there appears to be no published report of the occurrence of fungi of this family in Michigan. In California, on the contrary, twelve genera are recorded and many species, mainly through the work first of H. W. Harkness,[5] and more recently of Miss Gilkey.[6] Whether this great superiority in the number of known species is a true index to the relative frequency of occurrence of these forms in California and elsewhere in the country can be determined only when other botanists make as thorough a search for them as did Harkness, Miss Gilkey, and their collaborators. In California these workers made deliberate search for these forms; elsewhere their discovery has been mainly a matter of chance.

In August, 1919, the senior author found a dozen or more specimens of a hypogaeous fungus at a point in Gogebic County,

[1] Contribution 65 from the Department of Botany, Michigan Agricultural College.

[2] Kauffman, C. H. Unreported Michigan fungi for 1907 with an outline of the Gasteromycetes of the state. Mich. Acad. Sci. Rept., 10: 63–84. 1908.

[3] Kauffman, C. H. Unreported Michigan fungi for 1910, with outline keys of the common genera of Basidiomycetes and Ascomycetes. *Ibid.*, 13: 215–249. 1911.

[4] Gilkey, H. M. Two new truffles. Mycologia, 12: 99–101. *Fig. 1.* 1920.

[5] Harkness, H. W. California hypogaeous fungi. Proc. Calif. Acad. Sci. 3d Ser., 1: 241–293. 1899.

[6] Gilkey, H. M. A revision of the Tuberales of California. Univ. of Calif. Publications Botany, 6: 275–356. *pls. 26–30.* 1916.

Michigan, not far from the Wisconsin line. They were found at a depth of three to eight centimeters in the black soil forming the upper ten centimeters or so, of the soil of a forest consisting of sugar maple, hemlock, yellow birch and balsam fir. The soil below this depth consisted of gray sand, moist but not wet. The black upper soil consisted of sand with a large admixture of leaf mold, with numerous needles of balsam fir throughout it, as well as roots and underground stems of various plants such as *Lycopodium lucidulum, Coptis trifolia, Oxalis acetosella, Dryopteris* sp., and *Viola* sp.

The fruiting bodies were found scattered at distances of two to ten centimeters throughout an area of about one square meter, the soil in this region being scantily filled with a loose gray mycelium which did not show on the surface of the soil and was not noticeably more abundant near the fruiting bodies.

The single, somewhat lobed cavity and distinct central opening and the slender paraphyses extending beyond the cylindrical eight-spored asci determine the fungus as belonging to the genus *Genea*. From *Hydnocystis* it differs in the somewhat lobed cavity and secondary cortex formed by the paraphyses projecting beyond the asci.

From the described species of *Genea* this fungus differs in its spore characters. Ordinarily the spores are spherical or slightly ellipsoidal and marked by papillae or warts; in these Michigan specimens the spore have no signs of warts or papillae but are smooth, except that the epispore may show some irregular folds. The spores, moreover, are not spherical or ellipsoidal, but in side view appear square or rectangular, except the apical spores which may be irregularly rounded. Through mutual pressure of the asci and paraphyses the former and their enclosed ascospores are more or less polygonal in cross section and in some cases almost square. In the latter case the central ascospores are actually cubical as they always appear to be when viewed from the side.

The hyaline spores when mature possess a spherical or slightly ellipsoidal hyaline endospore surrounded by a hyaline exospore that is often only very slightly developed laterally, but very much

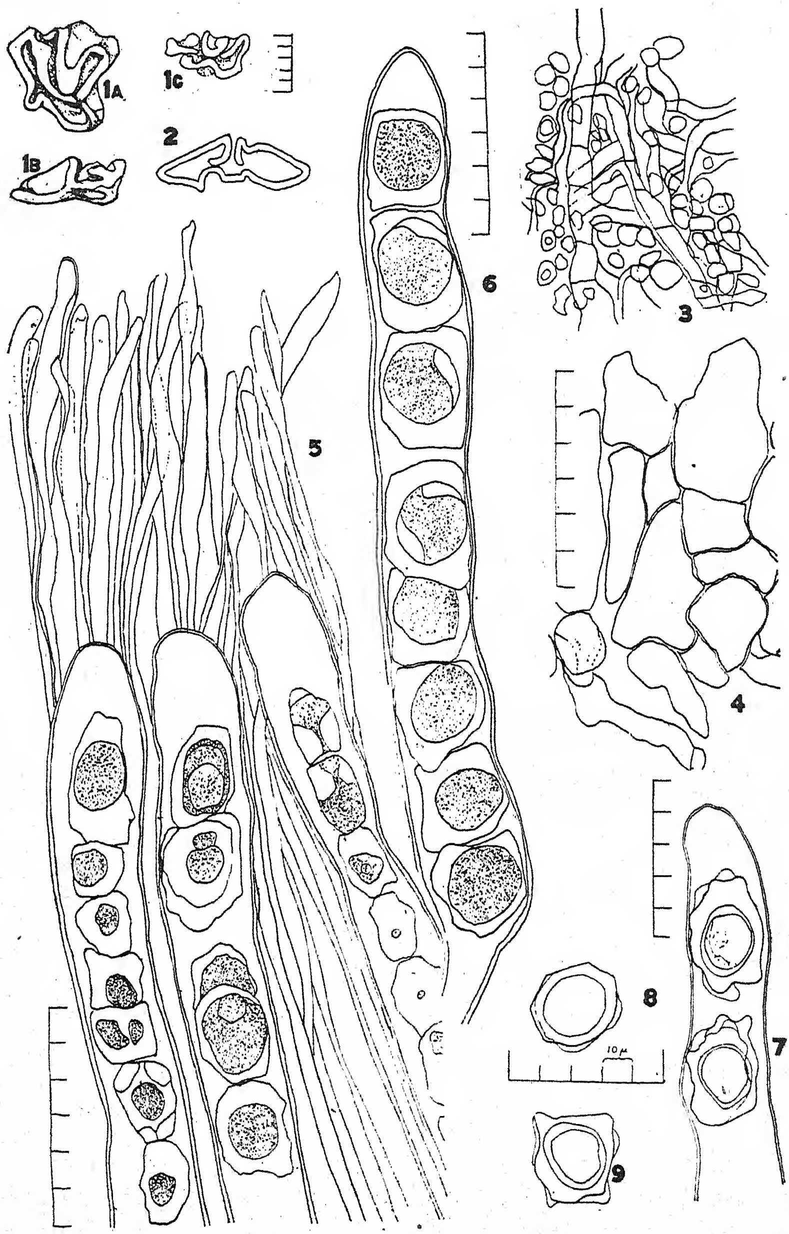
thickened at the end of the spores; particularly of those spores at or near the apex of the ascus. This exospore is externally thrown into folds but never into warts, prickles or tubercles.

Genea cubispora sp. nov.

Ascocarp when dry 7 to 9 mm. in diameter and 5 to 8 mm. in vertical thickness, slightly larger when fresh, with somewhat cerebriform external folds and involutions which have a tendency to radiate from the central opening. When fresh the whole surface was isabelline in color, but when dry and after handling the exposed convex edges of the folds are castaneous. Surface mealy and very slightly pubescent, surrounding mycelium scanty. Cavity single, but thrown into irregular pockets by the folds and involutions of the surface. Opening central, 1 to 2 mm. wide, the edge turned in nearly to the base of the cavity. Ascocarp wall 700 to 800 μ thick, the outer 100 to 150 μ consisting of large pseudoparenchymatous cells, the next 100 to 150 μ of tangled, frequently septate hyphae 5 to 10 μ in diameter, the remaining 500 to 600 μ consisting of the hymenium. Hymenium continuous, not areolate; asci cylindric, $300–350 \times 25–30 \mu$, rounded at the apex and tapering abruptly at the base. Paraphyses filiform, occasionally, but indistinctly, septate, overtopping the asci 75 to 110 μ and forming a secondary cortex. Ascospores eight, monostichous, the basal and central ones almost isodiametric, $27–28 \times 24–28 \mu$, the one or two nearest the apex often longer, $36–42 \times 24–28 \mu$. Lumen of spores 14–18 μ wide and 16–22 μ long; the endospore 1.2–3 μ thick. Epispore laterally 0.2–4 μ in thickness and 2–4 μ thick on the ends of all the spores except those at or next to the apex where the thickness reaches 5–10 μ. Epispore thrown into irregular folds but without papillae, tubercles or reticulations. Ascospores polygonal in cross section, occasionally even square.

In black leaf-mold 3 to 8 cm. below the surface in forest consisting of dense growth of *Acer saccharum, Tsuga canadensis, Betula lutea* with considerable *Abies balsamea*. Between Bass and Little Bass Lakes of the Cisco Lake chain, Gogebic County, Michigan, August 14, 1919. No. 123 Bessey and Darlington.

MICHIGAN AGRICULTURAL COLLEGE,
EAST LANSING, MICHIGAN.



GENEA CUBISPORA BESSEY & THOMPSON

EXPLANATION OF PLATE 20

Fig. 1*a*. Top view, 1*b*, edge view of same ascocarp, and 1*c*, top view of another ascocarp. Natural size.

Fig. 2. Vertical section through ascocarp. Natural size.

Fig. 3. Tissues from middle of wall of ascocarp.

Fig. 4. Tissues from exterior of wall of ascocarp.

Fig. 5. Upper portion of hymenium showing paraphyses extending beyond the asci in a sort of secondary cortex. Ascospores and asci not quite mature.

Fig. 6. An ascus with ascospores not quite mature.

Fig. 7. Apex of ascus showing two mature ascospores.

Fig. 8. Ascospore in cross section.

Fig. 9. Lateral view of a middle or basal ascospore.

NOTE: The small divisions of the scales accompanying the figures represent millimeters for Figures 1 and 2, and 10 μ in all the remaining drawings. Figures 3 and 4 are drawn to the same scale.

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor*]

Readers of MYCOLOGIA are invited to contribute to this department personal news items and notes or brief articles of interest to mycologists in general. Manuscript should be submitted before the middle of the month preceding the month in which this publication is issued.

It is said that eating the common ink-cap mushroom, *Coprinus atramentarius,* sometimes causes reddening of the face. Anyone who can corroborate this statement from his own experience or observation should publish the fact.

Dr. E. W. Olive, who has been connected with the Brooklyn Botanic Garden for several years, has retired from active scientific work to go into business with his brother at 904 Hume-Mansur Building, Indianapolis, Indiana.

A circle of fairy-ring mushrooms thirty feet in diameter was seen at Kingston, New York, July 10, in the yard of the famous old Dutch Reform Church. The mushrooms grew about the roots of trees, in the grass, and over graves with stones dating back as far as 1798.

The use of aged bean seed as a means of controlling bacterial blight of beans is advocated by C. W. Rapp in *Science,* p. 568, 1919. Seed four or five years old does not germinate well, but three-year-old seed yields a high percentage of vigorous plants with very little blight if the soil is free from the disease and no sources of infection are near.

Referring to the article entitled "Another New Truffle," published in the May number of *Mycologia,* Dr. C. L. Shear writes me as follows: "In order to make this story complete, I think it would be desirable to add a note referring to the fact that this

particular collection was mentioned by me in the *Asa Gray Bulletin* for December, 1899, under the heading 'A Truffle from Maryland.' If this connection is not pointed out it may not be known and confusion may arise. The specimens referred to in the note as *T. oligosperma* Tul. are the identical specimens which are described as the new species of *Tuber* in your article."

Excellent specimens of *Xanthoporia Andersoni* (Ellis & Ev.) Murrill were recently sent to the herbarium of the Garden for determination. They were collected on *Salix nigra* in Takoma Park, Maryland, May 5, 1920, by Hedgcock, Hahn, and Gravatt. This interesting species was first described from Newfield, New Jersey, where it was found by F. W. Anderson on an oak log. It has since been collected on poplar in Indiana, on oak in Missouri, and on elm or poplar in Ohio. The specimens recently received add a new host and a new state to its distribution.

Burt's eleventh paper on the Thelephoraceae of North America, published in the *Annals of the Missouri Botanical Garden* for November, 1919, includes *Tulasnella,* with 3 species; *Veluticeps,* with 1 species; *Mycobonia,* with 2 species; *Epithele,* with 2 species; and *Lachnocladium,* with 10 species from North Amercia. The following are new or newly combined: *Veluticeps tabacina* (Cooke) Burt, comb. nov.; *Epithele sulphurea* Burt, sp. nov., on palmetto in Florida; *Lachnocladium bicolor* (Peck) Burt, comb. nov.; and *L. erectum* Burt, sp. nov., on dead wood in West Virginia. The members of this genus are coralloid fungi usually occurring on wood or soil rich in humus. They resemble species of *Clavaria,* but are tomentose and leathery rather than fleshy, and therefore inedible. The spores vary from hyaline to ochraceous and from smooth to aculeate. *Lachnocladium Micheneri* Berk & Curt. is our commonest temperate species, ranging from Canada to New Jersey and westward to Missouri.

According to Paravicini, since the cultivation of the "English" walnut has been greatly extended in Switzerland the importance

of the larger fungi which attack this valuable tree has correspondingly increased. *Polyporus igniarius, P. fomentarius, P. hispidus, P. cinnabarinus, P. sulphureus,* and certain other fungi are mentioned among the enemies of the walnut, but, strange to say, *Favolus europaeus* is considered the most virulent of them all. It gains entrance through wounds in the branches. The only known method of treatment is to remove all diseased branches and cover the cut surfaces with grafting wax. This species is known to be fond of our native hickory trees and should be further investigated.

Burt's paper on *Aleurodiscus* in the *Annals of the Missouri Botanical Garden* for September, 1918, includes 14 North American species, all of which are illustrated by text-figures showing microscopic characters. According to the author, 25 species have been recognized for the genus: 8 in Europe, 5 in Asia and Australia, 2 in Africa, and 2 in South America. Most of our species are of local distribution. They are as follows: *Aleurodiscus amorphus* (Pers.) Rabenh.; *A. Farlowii* Burt sp. nov., on dead hemlock twigs in New Hampshire and New York; *A. Oakesii* (Berk. & Curt.) Cooke; *A. apiculatus* Burt sp. nov., on fallen dead wood in Jamaica, Porto Rico, and Grenada; *A. candidus* (Schw.) Burt comb. nov.; *A. strumosus* (Fries) Burt comb. nov.; *A. seriatus* (Berk. & Curt.) Burt comb. nov.; *A. nivosus* (Berk. & Curt.) v. Höhn. & Litsch.; *A. acerinus* (Pers.) v. Höhn. & Litsch.; *A. botryosus* Burt sp. nov., on dead stems of *Rubus* and *Vitis* in Massachusetts, Maryland, and Mexico; *A. cremeus* Burt sp. nov., on dead oak wood in New Mexico; *A. tenuis* Burt sp. nov., on dead twigs in Cuba; *A. penicillatus* Burt sp. nov., on dead wood of *Pseudotsuga* and *Tsuga* in Idaho, Washington, and Oregon; and *A. Weirii* Burt sp. nov., on decaying wood of *Abies, Thuja,* and *Larix* in Idaho and British Columbia.

The North American species of the genus *Hymenochaete* are treated by Burt in the *Annals of the Missouri Botanical Garden* for November, 1918; the majority of the 37 species included

being illustrated by halftones of the hymenophores and figures in the text showing the character of the setae. According to the author, in the simplest condition of the fructification in this genus, only a setigerous layer is present; in the next degree higher of development, a hyphal layer connects the setigerous layer with the substratum or may be extended from the substratum as the upper surface of the pileus; while in a still more highly developed condition, the hyphal layer, is differentiated into an intermediate layer and a denser and dark zone, and usually into a second hyphal layer adnate to the substratum or forming the surface of the pileus. In addition to the distinctive morphological character of elongated, conical setae in the hymenium, there is also a chemical substance in the tissue of all the species of *Hymenochaete* studied, that causes an immediate darkening of sections when dilute potassium hydrate is brought in contact with them. *Hymenochaete* is a genus of tropical species rather than of the cooler portion of the north temperate zone; for, in contrast with the 29 species occurring from the Gulf States to Brazil, only 13 species are known north of the latitude of Virginia, and from Europe perhaps 9 species, of which 6 are well known.

The following species are described as new: *H. borealis* Burt sp. nov., on dead frondose wood from Ontario to New Jersey; *H. reflexa* Burt sp. nov., on dead wood in Jamaica; *H. cubensis* Burt sp. nov., on dead wood in Cuba and Porto Rico; *H. ungulata* Burt sp. nov., on dead wood in Mexico; *H. digitata* Burt sp. nov., on dead logs in Panama; *H. fulva* Burt sp. nov., on fallen branches in Louisiana and Jamaica; *H. pinnatifida* Burt sp. nov., on fallen branches from Georgia to Louisiana and in Mexico, Cuba, and Jamaica; *H. multisetae* Burt sp. nov., on fallen branches in Cuba and Jamaica; *H. anomala* Burt sp. nov., on fallen branches in Cuba; and *H. opaca* Burt sp. nov., on dead branches in Jamaica.

ONYGENA EQUINA (WILLD.) PERS.

On May 1, 1920, I collected excellent specimens of *Onygena equina* (Willd.) Pers. on cow's horns and on part of a cow's hoof

in Morgan's woods, north of Macdonald College, Quebec, Canada. So far as I can ascertain the horns and hoofs had been lying in the woods for some five years, the cattle having been killed and buried there as being tubercular.

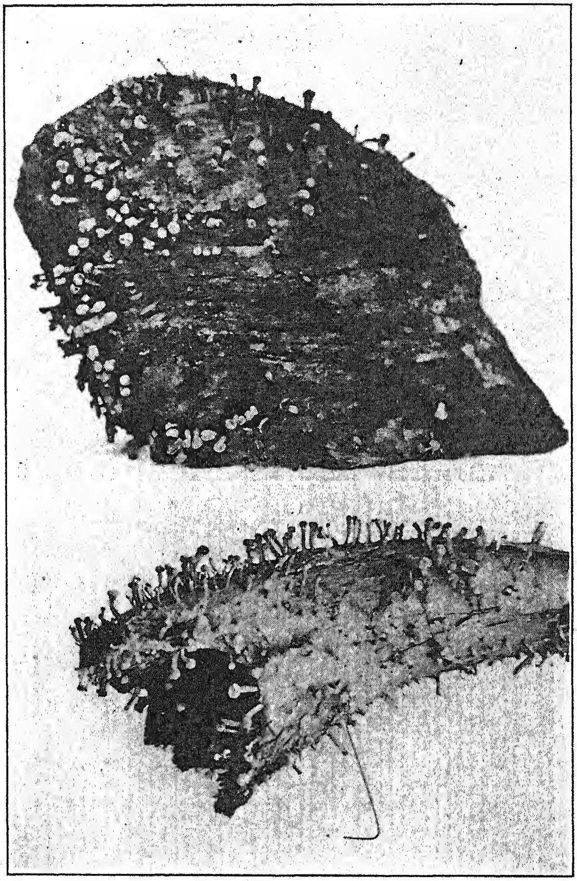


Fig. 1. The upper specimen shows fructifications on a cow's hoof. The variation in the size of sporocarps is noticeable, and the uppermost and lowest show the gleba exposed by dehiscence of the peridium. In the lower specimen figured, some sporocarps are seen to have developed from the inner surface of the horn.

The development of sporocarps was so good that photographic records were made. In each photograph variations in the size

of head and length of stipe are easily seen. The dehiscence of the peridium is plain and the exposed mass of spores and capillitium appears dark in the photographs as in nature.

Marshall Ward gives a very complete description of the fungus and of his cultural experiments with it in Vol. 191 B of the Philosophical Transactions of the Royal Society of London for 1899. A brief description of the fungus may not be out of place:

Fructification rounded, stalked or sessile, 1 to 5 mm. in height; peridium whitish, dehiscing irregularly or in lobes; asci globoid, 8-spored, 10 to 14 μ by 14 to 22 μ; ascospores yellowish to hyaline, 4 to 5 μ by 7 to 9 μ.

The asci are very difficult to obtain in good condition when dissecting sporocarps which are mature or nearly so since they readily rupture and collapse after the dispersal of the ascospores.

B. T. DICKSON.

MACDONALD COLLEGE,
QUEBEC, CANADA.

A NEW AMANITA

This species is dedicated to the discoverer, Professor H. L. Wells, of the Sheffield Scientific School of Yale University, who has carefully studied it for several years. The accompanying description is drawn up from his ample field notes and photographs. Limited space forbids further discussion of this beautiful species here, but a more extended treatment will be prepared by Dr. Kelly and Mr. Krieger from notes and illustrations which I shall furnish them.

Venenarius Wellsii sp. nov.

Pileus globose to convex, at length expanded, becoming nearly plane, gregarious, 5 to 10 cm. broad when expanded; surface dry, salmon-colored, fading, especially after a rain, usually remaining more deeply colored on the disk, covered with exceedingly minute, yellowish-buff warts, mostly distributed irregularly in large patches; margin of young plant usually showing a very delicate, bright-yellow tomentum, not striate at first, but becoming distinctly so and showing the gills about halfway to the center, extending beyond the gills about 2 to 3 mm. forming a conspicuous sterile edge, colored like the pileus when viewed from below:

context easily separable from the cuticle, bright-yellow, becoming buff with age, at first mild to the taste, but with a lingering unpleasantness; lamellae free or adnexed, about 1 cm. wide to narrower at the stipe, moderately crowded, pale-dull-yellow, edges at first distinctly furfuraceous; spores ellipsoid, smooth, rounded at the ends, obliquely apiculate at the base, hyaline, uni-guttulate, $12 \times 7 \mu$; stipe tapering upward, bulbous at the base, stuffed or hollow, clothed with a very delicate, furfuraceous layer above the annulus, nearly glabrous below, pale-dull-yellow, 7 to 12 cm. long; annulus distinctly yellow, very delicate and loosely woven, thin, usually adhering to the margin of the cup in an appendiculate way after rupture, and leaving but a slight, delicate ring on the stipe; volva very delicate and loosely woven, distinctly yellow, sometimes pointed, but more often nearly flat at the base, soon glabrous, becoming less distinct with the growth of the plant.

Type collected in the township of Springfield, New Hampshire, about September 1, 1917. Known from several other localities in New Hampshire, also.

For the benefit of those following Saccardo, I add the combination **Amanita Wellsii.**

W. A. MURRILL.

CULTURES OF PUCCINIA CLEMATIDES (DC.) LAGERH. AND PUCCINIA IMPATIENTIS (SCHW.) ARTH.

During 1917 and 1918 the baneberries, *Actaea alba* (L.) Mill. and *A. rubra* (Ait.) Wild., which grew in a small wood near Ste. Anne de Bellevue, P. Q., were heavily infected with aecia. Field evidence suggested the connection of these aecia with *Puccinia Clematidis* (DC.) Lagerh. on *Hystrix patula* Moench. Roots of *Actaea rubra* were dug up in the fall and kept in a cool cellar during the winter. When placed in a greenhouse in the spring, they developed rapidly. Wintered telial material of *Puccinia Clematidis* on *Hystrix patula* was tested and found visible. Inoculations were made on three pots of *Actaea rubra* on April 28th. Aecia were first noticed on May 5 and a very heavy infection developed. One pot of plants kept as a check remained free from infection. The inoculations and observations connected with these cultures were made by Mr. P. I. Bryce, of the Biology Department of Macdonald College, who also made the

collections and field observations on *Actaea* that suggested them.

The aecia on the infected plants, especially on the stems, produced abundant ascospores for some time. A number of grasses grown from seed in the greenhouse were inoculated with aeciospores from these cultures and also from aecia collected in the field on *Actaea rubra* at Ste. Anne de Bellevue. These inoculations and the observations in connection with them were made by Miss Margaret Newton, a graduate student of Macdonald College. The results are given in tabular form below.

Grass Inoculated	Source of Material	Date of Inoculation	Date of Uredinia	Nature of Infection
Elymus canadensis L.	Aecispores from culture on *Actaea*	June 13	June 22	Very heavy infection
Elymus virginicus L.	" " "	" "	" 23	" " "
Hordeum jubatum L.	" " "	" "	" "	Slight infection
Hystrix patula Moench.	" " "	" "	" "	Very heavy infection
Agropyron repens (L.) Beauv.	" " "	" "	" "	No infection
Agropyron Richardsonii Schrad.	" " "	" "	" "	Very heavy infection
Bromus ciliatus L.	" " "	July 12	——	No infection
Elymus virginicus L.	" " "	" "	July 21 Telia Aug. 13	Very heavy infection
Agropyron Richardsonii	" " "	" "	——	No infection
Hystrix patula	" " "	" "	No record	Very heavy infection
" "	Aeciospores from field collection on *Actaea*	" 10	July 20	" " "
Elymus canadensis	" "	" "	Telia Aug. 13	" " "
" *virginicus*	" "	" "	July 19	" " "

The material from the cultures was studied by Dr. E. B. Mains with the aid of Dr. Arthur's herbarium. He found that the aecial and telial material corresponded to the herbarium material of the European *Puccinia Actaeae-Elymi* Mayor and *P. Actaeae-Agropyri* Ed. Fisch. The urediniospores were somewhat smaller than is usual in *Puccinia Clematidis*. It seemed as if all these should be considered as belonging to one species, but probably representing several races for whose delimitation further culture work is necessary. They all belong in the species *Puccinia Clematidis* (DC.) Lagerh. as it has been considered by Arthur in North America.

These experiments and studies seem to establish the connec-

tion of the aecia on *Actaea rubra* (Ait.) Wild. with *Puccinia Clematidis* (DC.) Lagerh on *Hystrix patula* Moench. and also show that *Elymus canadensis* L. and *E. virginicus* L. are congenial hosts.

Further experiments were made at Saskatoon, conducted by Miss Hulda Haining, with aecia collected at Brandon, Man., on *Thalictrum dasycarpum* Fischer & Lall. Inoculations were made on the following grasses grown from seed in the greenhouse: *Bromus ciliatus* L., *B. latiglumis* (Shear) Hitchk., *Elymus canadensis* L., *E. virginicus* L., *Agropyron repens* (L.) Beuv., *A. Smithii* Rydb., *A. tenerum* Vasey, *A. Richardsonii* (Trin.) Schrad, and *Hordeum jubatum.* L. *Bromus ciliatus* and *latiglumis* were heavily infected and uredinia and telia developed abundantly. *Elymus canadensis* and *E. virginicus* were also heavily infected, but the others showed no infection. On *Bromus* the teliospores were of the many-celled type, on *Elymus* they were of the ordinary two-celled kind. It seems probable that the plants of *Thalictrum* used in the cultures contained a mixture of aecia of two races, one infecting *Bromus* and producing multicellular teliospores, and the other *Elymus* with the two-celled type of teliospores, as was indicated by the experiments in 1918. (See under *Puccinia Agropyri* E. & E. Mycologia 11: 131. 1919.)

PUCCINIA IMPATIENTIS (Schw.) Arth.

Inoculations were made in the greenhouse at Saskatoon with aeciospores from aecia collected at Dauphin, Man., on *Impatiens biflora* Walt. on the following grasses grown from seed in the greenhouse: *Agropyron Smithii, A. tenerum, A. Richardsonii, Hordeum jubatum, Elymus canadensis, E. virginicus*, and *Triticum vulgare*. There was a slight infection of *A. tenerum, A. Richardsonii,* and *Hystrix patula* and rather heavy infection of *Elymus canadensis* and *E. virginicus* and heavy infection of *Hordeum jubatum*. Three inoculations were made on *Hordeum jubatum* and heavy infection resulted in each case. (See Mycologia 11: 131. 1919.)

Inoculations were also carried out at Macdonald College by Miss Margaret Newton with aecia on *Impatiens biflora* Walt. collected at Hudson, P. Q., on the following grasses grown from

seed in the greenhouse: *Hordeum jubatum, Elymus canadensis, E. virginicus,* and *Hystrix patula.* Both species of *Elymus* were very heavily infected and *Hordeum* was slightly infected. Another inoculation was made on *Hordeum jubatum* and slight infection followed. As the plants of *Hordeum jubatum* used in these experiments were not in a healthy condition little value can be placed on the results which tend to show that *Hordeum jubatum* is not a congenial host in Eastern Canada. Arthur has shown by several cultures that the aecia on *Impatiens* are connected with *Puccinia Impatientis* on *Elymus.*

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LIGHT-COLORED RESUPINATE POLYPORES—II

WILLIAM A. MURRILL

Continuing the series of articles begun in *Mycologia* for March, 1920, descriptions and notes are here given of a number of resupinate polypores found mostly in the mycological herbarium of the New York Botanical Garden.

28. PORIA RIMOSA Murrill, Mycologia **12**: 91. 1920

This species was described from an unnumbered packet of specimens collected on *Juniperus monosperma* in New Mexico, October 23, 1911, by Hedgcock and Long. I have recently come across other packets of the same thing carefully laid away under a manuscript name assigned, I believe, by Mr. Long. I regret that I did not have this name at hand to use in publishing the species. One packet bears the same data as the type of *P. rimosa,* with the statement that the fungus follows the rot caused by *Fomes texanus.* Another specimen was collected on *Juniperus sabinioides* near Austin, Texas, November 16, 1911, *W. H. Long 12024.* It also followed rot caused by *Fomes texanus.* A third specimen was collected by Mr. Long on dead fallen logs of *Juniperus* at Cache, Oklahoma, September 29, 1912; while a fourth, numbered *9870,* was obtained by Long and Hedgcock from a stump of *Juniperus monosperma* in New Mexico. The hymenium of these additional specimens is not nearly so closely rimose as in the type and the tubes are considerably longer.

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29. PORIA SEMITINCTA (Peck) Cooke, Grevillea 14: 115. 1886

Polyporus semitinctus Peck, Ann. Rep. N. Y. State Mus. 31: 37. 1879.

Described as follows from specimens collected by Peck on the under surface of maple chips at Griffins, Catskill Mountains, New York, in September.

"Subiculum thin, soft, cottony, separable from the matrix, whitish, more or less tinged with lilac, sometimes forming branching creeping threads; pores very short, unequal, whitish or pale cream-color, the dissepiments at first obtuse, then thinner, toothed on the edge.

"This is a soft, delicate species, with merulioid pores, similar to those of *P. violaceus*. The lilac stains appear on the subiculum only."

Three collections of this species in addition to the type are at Albany, collected by Peck at Ballston, South Bethlehem, and Lyndonville. According to Overholts, the spores measure $3–4 \times 2\,\mu$.

In the herbarium here, there is an excellent specimen from the "Catskill Mts." sent by Peck to Ellis, which is attached to chips and leaves and shows shallow tubes and a wide margin with rhizomorphic strands. During a recent visit to Albany, I compared this with Peck's type and found the two identical.

Another specimen, collected by Fairman at Lyndonville, New York, in 1890, was sent to Ellis for determination, but was never named. It corresponds in form to those at Albany from Ballston and South Bethlehem. The largest collection we have was made by Ellis at Newfield in October, 1879, on dead stems of *Kalmia latifolia* still standing. This bears the name "*Pol. aneirina* Fr.," doubtless assigned it by Cooke, and is described by Ellis as "Milk-white with a narrow, radiate-fibrose, snow-white margin. Pores oblique, medium size, margins thin, suberose."

30. PORIA MYCELIOSA Peck, Bull. N. Y. State Mus. 54: 952. 1902

"Subiculum membranaceous separable from the matrix, connected with white branching strands of mycelium which permeate the soft decayed wood, or with radiating ribs which run through the broad sterile fimbriate white margin; pores very

short, subrotund angular or subflexuous, the dissepiments thin, acute, dentate or slightly lacerate, pale yellow; spores minute, subglobose, .00008–.00012 of an inch broad."

Described from specimens collected by Peck on much-decayed hemlock wood at Floodwood, New York, August 31, 1900. According to Overholts, the spores are ellipsoid, smooth, hyaline, 2.5–4 x 2 μ; cystidia none; clamp connections abundant. I have a specimen collected by Atkinson in North Carolina which appears to match the type at Albany exactly. Overholts also reports it from Frankfort, Michigan, collected on hemlock wood by E. T. Harper. This species should be very carefully compared with *Poria semitincta*, from which it can scarcely be distinguished when the herbarium specimens are placed side by side.

31. PORIA RADICULOSA (Peck) Sacc. Syll. Fung. 6: 314. 1888

Polyporus radiculosus Peck, Bull. N. Y. State Mus. 40: 54. 1887.

"Resupinate, effused, thin, soft, tender, orange-yellow, the mycelium creeping in and over the wood, silky-tomentose, at first white, then yellow, forming numerous yellow branching root-like strings or ribs which are more or less connected by a soft, silky tomentum; pores rather large, angular, at first shallow, sunk in the mycelium, the dissepiments becoming more elevated, thin and fragile; spores ellipsoid, .0002 to .00025 inch long, .00012 to .00016 broad.

"The species is allied to *P. Vaillantii,* in its peculiar rhizomorphoid strings of mycelium, but from this it differs decidedly in its color and texture. In these respects it approaches *P. bombycinus,* of which it may possibly be a peculiar variety. It is very destructive to the wood on which it grows, causing it to become soft, brittle and even friable."

Described as above from specimens collected by Peck at Gansevoort in September on half-buried aspen chips. I have examined the type at Albany and find it very unsatisfactory. The plate recently published by Mr. Overholts represents it well. According to him, the spores are oblong-ellipsoid, 5–7.5 x 2.5–3 μ; cystidia none. The species will not be satisfactorily known by the present generation of mycologists until rediscovered.

32. PORIA FIMBRIATELLA (Peck) Sacc. Syll. Fung. 6: 303. 1888

Polyporus fimbriatellus Peck, Ann. Rep. N. Y. State Mus. 38: 91. 1885.

Originally described as follows from specimens collected by Dr. Peck on maple logs at Osceola, New York, in August. Also collected by him on a maple trunk at Ampersand Pond.

"Widely effused, thin, tenacious, separable from the matrix, with a thin white fimbriate margin and a white subiculum, running into rhizomorphoid branching strings of mycelium or forming a somewhat reticulate fimbriate membrane; pores minute, subrotund, equal, whitish inclining to cream color.

"By its rhizomorphoid mycelium this species is related to *P. Vaillantii*, but the pores are smaller and not collected in heaps as in that species. By reason of its tenacious substance it is readily separable even from an irregular matrix."

I have recently had an opportunity to examine the types of this species, which are well preserved at Albany. According to Overholts, the spores are ellipsoid, $2.5–3.5 \times 2\,\mu$; cystidia pointed, abundant, reaching $10–15\,\mu$ in diameter and projecting $10–30\,\mu$.

33. PORIA GRISEOALBA (Peck) Sacc. Syll. Fung. 6: 306. 1888

Polyporus griseoalbus Peck, Ann. Rep. N. Y. State Mus. 38: 91. 1885.

Described as follows from specimens collected by Peck on soft, decaying wood of deciduous trees at Osceola, New York, in July.

"Effused, thin, tender, adnate, uneven, scarcely margined, indeterminate, grayish-white, with a thin pulverulent subiculum; pores very minute, subrotund, often oblique.

"The pores are sometimes collected in little heaps of tubercles as in *P. molluscus* and *P. Vaillantii*. In the dried state they are slightly tinged with creamy yellow."

The type specimens at Albany are pure-white, delicate, with fairly regular hymenium, reminding me somewhat of *Poria tenuis* Schw. and of plants referred to *Poria vulgaris* by many American mycologists.

34. **Poria linearis** sp. nov.

Effused for many centimeters, continuous, inseparable, thin; margin not cottony, but membranous to leathery, appressed, broad and conspicuous, white or whitish; context quite conspicuous, tough, membranous, white to cream-colored, persistent; hymenium appearing in scattered areas over the subiculum, becoming continuous but remaining somewhat uneven, white to pale-isabelline and at length pale-avellaneous; tubes rigid, thick-walled, oblique and appressed, often elongated to 1 cm. in length, 3 to a mm. or larger, mouths irregular, edges subentire; spores pip-shaped, smooth, hyaline, 5–7 x 3–4 μ.

Type collected on a dead, standing, corticated, hardwood trunk at Marraganti, Panama, April 3–9, 1908, *Robert S. Williams 1127*. Mature specimens are remarkable for the series of interrupted parallel lines made by the obliquely appressed, greatly elongated tubes.

35. **Poria hondurensis** sp. nov.

Effused for several centimeters, the area covered much longer than wide, continuous, inseparable, thin; margin not cottony, inconspicuous, white; context inconspicuous, a mere whitish membrane; hymenium even, milk-white and unchanging, considerably cracked in dried specimens; tubes rigid, angular, less than 1 mm. long, 3–4 to a mm., edges thin-walled, entire; spores ellipsoid, smoth, hyaline, 4 x 2.5 μ.

Type collected on the trunk and branches of a dead hardwood tree in British Honduras, during the winter of 1907, by *Morton E. Peck*. The wood remains rather firm but the bark has disappeared where the fungus occurs.

36. **Poria Johnstonii** sp. nov.

Effused for several centimeters, becoming continuous by confluence, inseparable, thin; margin conspicuous, cottony, milk-white even in dried specimens, much reduced with age; context thin, milk-white, of loosely-woven, cottony strands quite different from the usual membrane; hymenium uneven, white to cream-colored; tubes oblique, uniform in size and appearance, about 1 mm. long, angular, thin-walled, 3 to a mm., the edges projecting in long teeth; spore characters not satisfactorily obtained.

Type collected on the under side of a log of *Pseudotsuga macrocarpa* in the Upper San Antonio Canyon, San Antonio Mountains, Southern California, 5,700 ft. elevation, December 15, 1918, *I. M. Johnston 252*.

37. **Poria salicina** sp. nov.

Effused for many centimeters, becoming continuous by confluence, inseparable, rather thick; margin slight, appressed, fimbriate, white, inconspicuous with age; context a white membrane as thin as writing-paper; hymenium very uneven, white to cream-colored, glistening; tubes very thin-walled, somewhat collapsing and friable, mostly angular, very irregular in size and shape, 2–3 mm. long, usually about 3, but sometimes only 1, to a mm., edges becoming toothed or lacerate; spores ellipsoid, smooth, hyaline, $4.5 \times 2.5\ \mu$.

Type collected on a dead willow trunk at Fern Hollow, near Pittsburgh, Pennsylvania, October 16, 1906, *David R. Sumstine 25*. Also collected by Mr. Sumstine on the same host at Kittanning, Pennsylvania, September 8, 1907.

38. **Poria perextensa** sp. nov.

Covering the under side of a large log, practically continuous, inseparable, thin; margin conspicuous, white, felty or cottony, the extreme edge composed of appressed, radiating fibers, often connected with mycelial cords; context white, membranous, persistent; hymenium uneven, following the irregularities of the substratum and developing in patches on the subiculum, at length continuous and changing from white to ochroleucous and finally isabelline; tubes shallow and reticulate at first, maturing slowly, becoming 1 mm. long, angular, thin-walled, unequal, pliable and soft but not collapsing, 2–3 to a mm., edges entire to toothed or lacerate; spores subglobose to broadly ovoid, smooth, hyaline, $3\ \mu$ long.

Type collected on a much-decayed log of a deciduous tree at "Boarstone Camp," north of Willimantic, Maine, September 12–14, 1905, *W. A. Murrill 2520*. This camp, situated on the northern slope of Boarstone Mountain, was one of a number made by Mr. Ricker and myself during our explorations in Maine.

39. **Poria hymeniicola** sp. nov.

Appearing in circular patches on the hymenium of a dead *Tyromyces* and increasing to 2 cm. or more in diameter, continuous, inseparable, rather thick; margin cottony, conspicuous, pure-white even in dried specimens; context white, scarcely visible as a membrane but filling many of the tubes of the *Tyromyces*; hymenium uneven, white, glistening; tubes angular, thin-walled, reaching 2 mm. in length, about 5 to a mm. at maturity, a few considerably larger, edges entire to slightly toothed; spore characters not satisfactorily obtained.

Type collected on old hymenophores of a species of *Tyromyces* attached to a dead poplar trunk at "Camp Sunday," Medford Township, Maine, August 28, 1905, *W. A. Murrill 1920.*

40. **Poria separans** sp. nov.

Widely effused, continuous, separating smoothly from the substratum, rather thick; margin thin, cottony, white to cream-colored, scarcely apparent in old specimens; context a thin, tough, persistent, white membrane; hymenium very even, glistening, white to cream-colored; tubes thin-walled but not collapsing, regular in shape and size, reaching 2 mm. in length, concolorous within, angular, 4 to a mm., edges fimbriate-dentate; spores subglobose, hyaline, smooth, 5 μ.

Type collected on a dead log at East Hebron, New Hampshire, July 6, 1917, by *Percy Wilson.*

41. **Poria roseitingens** sp. nov.

Appearing in small, irregular patches on the bark and becoming several centimeters in extent by growth and confluence, inseparable, thin; margin filamentous, appressed, pure-white even in dried specimens, conspicuous in age; context white, a mere membrane; hymenium only tolerably even, milk-white when fresh, pale-rosy-isabelline when dry, except on the margin; tubes rather firm, very irregular in size, mostly 3 to a mm,, but often 1 mm. broad or larger, concolorous within, angular, thin-walled, edges entire to toothed or somewhat lacerate; spores copious, ellipsoid, hyaline, smooth, 3–4 x 2–2.5 μ.

Type collected on a dead corticated log of *Pinus Massoniana* at Cinchona, Jamaica, 5,000 ft. elevation, December 25–January 8, 1908–9, *W. A. & Edna L. Murrill 407.*

42. **Poria Cokeri** sp. nov.

Appearing first in circular patches a few millimeters across, then increasing to a centimeter, and finally becoming confluent in areas 5 cm. or more long and 2 cm. wide, inseparable, rather thick, especially at the center of the patches; margin coarsely radiate-fibrous to membranous, conspicuous, 2–3 mm. broad when fairly young, milk-white even when dry; context white, membranous; hymenium somewhat uneven, white to slightly dirty-white, pale-ferruginous where bruised; tubes quite rigid, irregular in shape and size, 2–3 mm. long, concolorous within, mouths irregularly rounded or slightly angular, usually 3, but sometimes only 1, to a mm., edges entire to toothed; spores rounded-ovoid, smooth, hyaline, with a very distinct nucleus, $4 \times 3\ \mu$.

Type collected on dead stems of a hedge of *Ligustrum vulgare* at Chapel Hill, North Carolina, December 9, 1914, *W. C. Coker 1506*. What appears to be the same species was collected on rotting hardwood logs at Star City, West Virginia, May 3, 1907, *Carl P. Hartley 51*.

43. **Poria distorta** sp. nov.

Widely effused, following the irregularities of the substratum, more or less continuous, separable, of medium thickness, drying in concave, distorted masses; margin broad when young, white to slightly discolored, cottony to membranous; context white, conspicuous, tough, membranous, persistent; hymenium very uneven, often nodulose, white to cremeous or somewhat discolored; tubes often oblique, fairly regular in shape and size when fully mature, 1–2 mm. long, concolorous within, thin-walled, angular, 4–5 to a mm., edges rather firm, entire to slightly toothed; spores ellipsoid, smooth, hyaline, $3.5 \times 2.5\ \mu$.

Type collected on very rotten wood in Pink Bed Valley, near Asheville, North Carolina, about 4,000 ft. elevation, July 13–24, 1908, *W. A. Murrill & H. D. House 427*.

44. **Poria submollusca** sp. nov.

Effused for several centimeters, continuous, inseparable, thin; margin cottony, delicate, conspicuous, milk-white even in dried specimens; context white, membranous; hymenium rather even, white, slightly cremeous in dried specimens; tubes mostly oblique, showing a tendency to collapse at times, becoming irregular in size and shape, 1–2 mm. long, concolorous within, thin-walled,

mouths angular, 4–5 to a mm., edges at first entire but soon becoming notched or lacerate; spore characters not satisfactorily obtained.

Type collected on rotting bark and wood of hickory at St. Martinsville, Louisiana, August 3, 1889, *A. B. Langlois 1883*. What appears to be the same species is in the Underwood herbarium, collected at Ocean Springs, Mississippi, in 1896, on decayed pieces of the wood and bark of some deciduous tree.

45. **Poria lignicola** sp. nov.

Effused for several centimeters, becoming continuous, closely adhering, inseparable, thin; margin broad, conspicuous, white to pale-isabelline, cottony; context tough, membranous, persistent, pale-isabelline; hymenium even, glistening, pale-rosy-isabelline; tubes rigid, regular, angular, less than 1 mm. long, often oblique, thin-walled, 3–4 to a mm., edges almost entire; spore characters not satisfactorily obtained.

Type collected on a decorticated hardwood log at Alto Cedro, Cuba, March 19–20, 1905, *F. S. Earle & W. A. Murrill 482*. Also collected at the same time on a similar host, *F. S. Earle & W. A. Murrill 448*.

46. **Poria montana** sp. nov.

Effused for several centimeters, continuous, inseparable, rather thick; margin very slight, thin, closely appressed, pure-white even in dried specimens; context white, ordinarily a mere membrane, but in cracks or hollows in the decayed substratum becoming dense and cottony; hymenium even, glistening, white to straw-colored; tubes rigid, fairly regular in shape and size, angular, about 6 to a mm. and reaching 3 mm. in length, edges thin, entire; spore characters not satisfactorily obtained.

Type collected on a well-rotted coniferous trunk near New Haven Gap, above Cinchona, Jamaica, 5,600 ft. elevation, January 4, 1909, *W. A. & Edna L. Murrill 765*.

47. **Poria arachnoidea** sp. nov.

Effused for several centimeters, continuous, inseparable, thin; margin broad and very delicate, like a spider's web, white to cream-colored; context inconspicuous; hymenium even, white to

cream-colored, glistening, continuous at maturity; tubes delicate, regular, angular, scarcely 1 mm. long, 4 to a mm., edges very thin-walled, entire; spore characters not satisfactorily obtained.

Type collected on a much-decayed piece of oak wood near St. Martinsville, Louisiana, October 25, 1897, *A. B. Langlois 2556*. Also collected at Opeloussas, Louisiana, May 14, 1889, *A. B. Langlois 1734*. Accompanying the latter specimen is a field note referring to the arachnoid, white subiculum as a very peculiar character.

NEW YORK BOTANICAL GARDEN.

DARLUCA ON PERIDERMIUM PECKII*

J. F. Adams

(With Plate 21)

The genus *Darluca* in the family Sphaeropsidiaceae of the Fungi Imperfecti includes species which are reported on the leaves of deciduous plants as well as being parasitic on the Uredineae.

Darluca filum (Biv.) Cast. is a species most commonly mentioned as a frequent parasite on various species of Uredinales. Saccardo[15] states that it is uredinicolis and Sydow[18] and Grove[9] refer to it as a parasite growing on the uredo layer. Lindau[11] reports it as cosmopolitan on aecidia of various uredinia. Rostrup[14] lists it on *Chrysomyxa abietis* (2346). Cornu[7] says it attacks the telia of *Puccinia Prunorum* and *Puccinia Caricis*. Fuckel[8] finds it on urediniospores of various species and teliospores of *Uromyces Cytissi*. Tulasne[19] reports *Diplodia punctata* which corresponds to *Darluca filum* on *Uredo farinosa, U. falicis, U. Euphorbiae* and *U. Epilobii*. Broisi[3] has mentioned this parasite on *Puccinia bromia* and *Puccinia Triseti*.

McAlpine[12] finds it quite common for the uredo-layer to be attacked by this fungus and has found it upon 24 per cent of the species of *Puccinia*. "It occurs on aecidia, uredo and teleuto layers, and is recorded on *Uromyces, Uromycladium, Puccinia, Phragmidium* and in *Uredo*.

Cobb[6] unquestionably discusses this same parasite in connection with the peach rust (*Tranzschelia punctata*). He states "I frequently find among the Uredospores of a parasite of this rust small black pycnidia producing a multitude of two-celled spores, which when placed in a moist chamber often bud and multiply after the manner of yeast plants, but which occasionally produce a mycelium. Further, I find in the pustules of a number of Australian rusts similar tiny black pycnidia, producing similar two-

* Contribution from the Department of Botany, The Pennsylvania State College, No. 23.

celled spores which behave in precisely the same manner. Among other rusts producing these bodies is that occurring on Acacias, and that which occurs on a species of *Agropyron*, probably the species *scabrum*. There *a priori* two ways accounting for these pycnidia, either (1) they are parasites on the rust, or (2) they are an integral part of the rust, and represent another spore form of the rust." "These two-celled bodies have, as I have in several occasions publicly remarked, no slight resemblance to the so-called spermagonia of several species of *Aecidium* and this idea has already been fruitful of considerable discussion. Do not the various bodies that have in this connection been called spermagonia and spermatia need a more careful examination than they have yet received."

Halsted[10] reports it on the uredo sorus of the asparagus rust and "in some localities this parasite upon the asparagus rust has been so abundant as to make it difficult to find a fully developed rust spot free from *Darluca*." Sirrine[17] finds it spreads upon the uredo stage of the asparagus rust. "During past summer (1900) *Darluca* attacked the aecidial stage of the rust about June 10. We have even found sori in which the uredospores were apparently destroyed by *Darluca* while at the bottom of the sorus a layer of evidently healthy winter spores would be found." He is of the opinion "that *Darluca* attacks the spores of only the aecidial and uredo stages and does not injure the vegetative portions." Clinton[5] reports it on the aecia, uredinia and telia of the asparagus rust and occurring on the carnation and blue grass rust. Pammel and Hodson[13] consider it does much to prevent the ravages of the asparagus rust and report it common in 1900 on corn rust.

Darluca filum is frequently found on *Kueneola obtusa* in the eastern states. I have studied also material growing on *Coleosporium delicatulum* on *Euthamia tenuifolium* and on *Dicaeoma poculiforme* on *Phleum pratense*. Ellis and Everhart list *Darluca arcuata* on the andropogan rust which differs from *D. filum* by having three celled spores.

The parasite is easily recognized when found on the Uredinia and telia sori. It appears to overrun the sori after developing aggregate black pycnidia that appear as in a stroma. It apparently checks spore formation and distribution.

I have been unable to find in the literature where *Darluca filum* has been reported on any species of rusts attacking Gymnosperms. The writer collected material of *Peridermium Peckii* on *Tsuga canadensis* at Charter Oak, Center County, Pa., for study in the early stages of the development of the aecidium. The material was collected May 20, 1917 and at this time it was possible to find infected leaves with immature as well as sporulating aecia. The young infected leaves are easily recognized by their yellow appearance. At this time there was no evidence of *Darluca* growing on any of the rust infected leaves. The parasite was only recognized on examining sections through rust infected leaves of material collected in 1917.

During the spring of 1919 rust infected leaves of hemlock were carefully examined and in several instances mature aecia were found which were parasitized with *Darluca*. The black pycnidia could be recognized in the sori but not as conspicuous as found on other species of rust. The infection can be easily overlooked. Additional material was collected and fixed for further study.

On the leaves of hemlock, *Peridermium Peckii* forms two rows of conspicuous cylindrical aecia which are erumpent on the under surface. The pycnia develop subcuticularly and frequently were formed on the upper surface but more commonly on the under surface of the needle.

The mycelium of the rust is distributed throughout the leaf and the aecial primordia originate between the fibro vascular bundle and lateral resin duct. It has been observed that the aecia rupture at a stoma possibly because of least resistance. The mycelium of the parasite is similar in size to that of the rust but can be distinguished easily by the smaller nuclei, less cytoplasmic contents and sparsely septate mycelium.

Infection by *Darluca* may occur with the aecial primordia or mature aecia. When the primordia of the aecia are infected considerable disorganization of the rust mycelium occurs. The pycnidia of the parasite appear to suppress development by encroachment. The hyphae making up the aecial primordia do not show the normal nuclei or protoplasmic contents. These hyphae by their strong affinity for the stain and poor stainable contents

indicate their disorganization. No further cytological evidence could be observed between the parasite and rust. The preparations were examined carefully for haustoria or other penetration of the rust mycelium by the parasite. Where mature aecia are infected the parasite appears to be concerned in suppressing spore distribution. The pycnidia develop in the aecial cup with the peridia still entact. Only a few mature spores are found below the pycnidium. The mycelium of the parasite ramifies throughout the spore mass and appears to engulf the spores. Several instances were found where the pycnia were parasitized upon the upper surface of leaves. Considerable disorganization of the pycnia were observed to follow such infection. I have been unable to find in the literature where this rust stage has been reported infected by *Darluca*.

My observations indicate that the resultant effect of the parasite is to prevent aecia maturing and suppress spore distribution. Owing to the deep origin of the aecia, the pycnidia of the parasite are submerged or endogenous and not easily recognized in contrast to its growth on other species of rusts. This sort of hidden relation between parasite and rust may be more common than heretofore supposed.

Sappin Trouffy[16] has studied *Darluca filum* on the uredinia of *Puccinia Porri.* He finds the mycelium ramifies throughout the sori and becomes attached to the urediniospores by "crampons." It is stated that the parasite assumes a "rôle destructeur." His illustration (Fig. 2) shows the mycelium of the parasite in the uredinia with apparent haustoria penetrating the sub-basal cells of the sori as well as the "crampons" attached to spores. He finds the parasite presents the same characters on *Puccinia graminis* and *Puccinia Menthae.* I have been unable to observe this situation in any of my preparations.

The original description of *Darluca* by Castagne[4] and that given by Saccardo[15] is different with respect to the morphology of the spores. I have not been able to determine the reason for the change from the original description by Saccardo.[15] The following discussion presents the facts so far as I am able to determine regarding the presence or absence of bristle spores.

Bivona described this parasite as *Sphaeria filum* (Tab. 3, f. 1, C. C. D. E.) but no mention is made of bristle spores. Castagne[4] established the genus *Darluca* making *Darluca vagans* (Cast. herb.) and *Sphaeria filum* Biv. synonyms and the fungus then became known as *Darluca filum* (Biv.) Cast. Castagne[4] makes no reference to the presence of bristle spores and that he took cognizance of the other synonyms is indicated in the following quotation. "Cette plante a d'abord été décrité par Bivona sous le nom de *Sphaeria filum,* M. Fries dans son Systema mycologicum, t. 2, p. 547, en fit son *Phoma filum,* puis dans l'Elenchus fungorum, t. 2, p. 119, il l'a rangée dans le genre *Septoria*; elle devint le *Septoria filum.* M. le Docteur Montagne est de la même opinion et la place dans la tribu des *Ascospora*; C'est pour lui le *Septoria* (*Ascospora*) *filum.* M. le Docteur Léveillé pense que c'est un Diplodia qu'on pourrait désigner sous le nom de *Diplodia punctata*; M. Desmazieres en fait un *Hendersonia* et il le décrit sous le nom d'*Hendersonia uredinaecola* (Ann. des. Sc. Nat., 3 serie, t. 11, p. 345), et un *Diplodia* dans les Plantes Crypt. de France, 1486, sous le nom de *Diplodia uredinaecola*; enfin M. Berkeley, que j'ai consulté sur cette controverse, pense qu'on doit en faire un *Sphaeronema.* La variété d'opinion des premiers cryptogamistes d'Europe a' ce sujet, m'engage á proposer la création d'une genre nouveau pour botanistes sous le nom de *Darluca vagans.* Le Nom de *Darluca* est un hommage rendu á la mémoire de Michel Darluc, docteur en medecine, mort en 1783, anteur d'une histoire naturelle de Provence."

No mention is made of bristle spores in *Hendersonia* (*Sphaerospora*) *uredineaecola* Desmaz. or *Diplodia* (*Hyalospora*) *uredineaecola* Desmaz. The descriptions as well as the illustrations of the spores in *Phoma Filum* Fr. and *Darluca vagans* Cast. are without bristles.

So far as I have been able to determine the first mention of bristle spores is in Saccardo's[15] description of *Darluca* Cast. where he states that the spores are "untrinque mucosa—vel. subpenicillata-apiculatae" and in *Darluca filum* (Biv.) Cast. he states the spores are described as "breve mucosa-penicillatis." However, in the case of *Darluca Sorghi* Zimm. no mention is made of

bristle spores. Lindau[11] illustrates the spores with two or three bristles at each end.

Sappin-Trouffy[16] in his studies of this parasite has failed to observe the presence of bristle spores. Underwood[20] refers to the spores as similar to *Ascochyta* and *Actinonema* which are without bristle appendages. Blodgett[2] illustrated this parasite on the carnation rust but did not observe the presence of bristle spores.

I have failed to find the presence of bristles on young or mature spores of this parasite growing on the three species of rust I have studied. In this respect the form I have studied would agree with the original description of Castagne and Bivona. It is possible that another form appears similar to this species but with bristle spores, in which case it should be considered as a new species. A monograph of this genus undoubtedly would clear up the inconsistency with respect to the morphology of the spores. The bristles may be present only with young spores as indicated in the species *Darluca Bivonae* Fuckel as Allescher[1] reports the young spores possess bristle ends but absent with mature spores.

Saccardo[16] lists *Darluca Sorghi* Zimm. as a parasite on *Puccinia purpureae* without bristle spores. This species agrees with Castagne's original description as well as with the form I have studied.

The pycnidia vary somewhat in size on the three species of rust I have studied but agree with the measurements of other authors. Castagne says the spores vary from two to three celled but the three celled are rare. Slight variations in the spores are found but not so great as to designate them as separate species. I have found the spores uniformly two-celled. Saccardo gives the following measurements: *Darluca filum*, 3 to 4 x 15 to 18 μ; *Darluca Sorghi*, 4 to 13 x 16 μ. The following spore measurements I have taken from fresh material: *Darluca filum* (Biv.) Cast. on *Peridermium Peckii*, 3 to 4 x 13 to 19 μ; *Darluca filum* (Biv.) Cast. on *Coleosporium delicatulum*, 3 to 7 x 10 to 16 μ; *Darluca filum* (Biv.) Cast. on *Puccinia graminis*, 3 to 7 x 12 to 16 μ.

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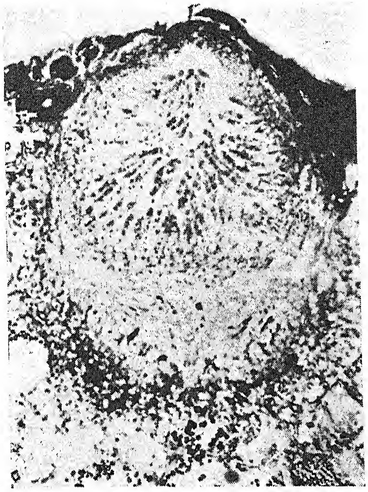

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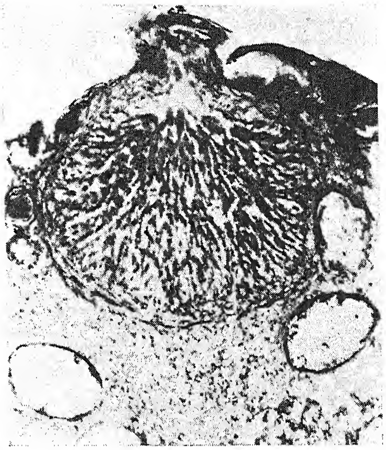

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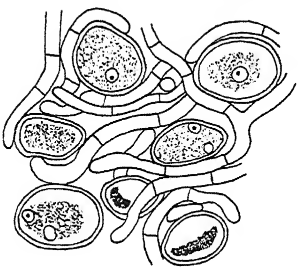

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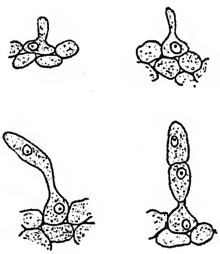

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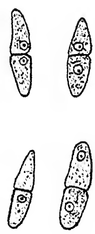

5

DARLUCA ON PERIDERMIUM PECKII

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EXPLANATION OF PLATE 21

Fig. 1. Photomicrograph of a cross section of the pycnidium of *Darluca filum* on the aecium of *Peridermium Peckii.* Just below the pycnidium the disorganized aecium is evident. The basal cells and sub-basal tissue is completely collapsed. Several aeciospores are evident below the pycnidium.

Fig. 2. Photomicrograph of a cross section of the pycnidium of *Darluca filum* on the primordium of the aecium of *Peridermium Peckii.* The primordium of the aecium is evident just below the pycnidium. The primordium is not disorganized but the cells have degenerated and show little protoplasmic contents. Early infection of a primordium prevents any further development.

Fig. 3. Mycelium of *Darluca filum* ramifying and engulfing the aeciospores in a mature aecium of *Peridermium Peckii.* Plasmolysis of the spores is associated with the establishment of *Darluca.*

Fig. 4. Various stages in spore development of *Darluca filum.*

Fig. 5. Typical two celled spores of *Darluca filum.*

A LIST OF THE PYRENOMYCETES OF PORTO RICO COLLECTED BY H. H. WHETZEL AND E. W. OLIVE[1]

Carlos E. Chardon

The following list of Pyrenomycetes of Porto Rico is based on material collected by Prof. H. H. Whetzel and Dr. E. W. Olive during a brief stay at the Island in the spring of 1916. A detailed account of their expedition need not be given here, since it has been previously published.[2] Their attention was directed mainly towards the rusts, but fungi belonging to other groups were also collected. The Pyrenomycetes stand in second place from the standpoint of the number of species collected. The Uredinales have been studied by Dr. J. C. Arthur,[3] and recently several papers have appeared dealing with some of the Pyreno mycetes[4, 5, 6]. However, a detailed list of the members of this group has not been published, and since many of them are discussed in the papers of Prof. F. L. Stevens and his students, it has been relatively easy to identify most of the specimens, in as far as they are known.

All doubtful determinations have been excluded. Specimens representing what are believed to be new species have been set aside for further study.

During the preparation of the list, help has been received from a number of mycologists. I wish especially to acknowledge my indebtedness to Prof. F. L. Stevens of the University of Illinois, Prof. C. R. Orton of Pennsylvania College, Mr. C. G. Lloyd of Cincinnati, Ohio, Prof. F. S. Earle of the Insular Experiment Station at Rio Piedras, P. R., and Dr. F. J. Seaver of the New

1 Two species of Hysteriales are included.
2 Brook. Bot. Gard. Rep. 5: 117–121. 1916.
3 Mycologia 9: 55–104. 1917.
4 Mycologia 11: 163–167. 1919.
5 Mycologia 12: 93–98. 1920.
6 Mycologia 12:206–267. 1920.

York Botanical Garden. Finally, an expression of my appreciation is due to Prof. H. M. Fitzpatrick, who suggested the publication of the list and who assisted in the preparation of the manuscript, and to Prof. H. H. Whetzel, who has placed at my disposal all of his material.

A total of 112 specimens, representing 65 species, is listed below. The date of the collection has been omitted in all cases. Following the citation of the locality, the accession numbers applied to the specimens by the collectors are given.

I. HYSTERIALES

1. LEMBOSIA COCCOLOBAE Earle.
   On *Coccolobis uvifera*. Mayaguez, *522, 523*.
2. LEMBOSIA DIFFUSA Winter.
   On *Miconia prasina*. Maricao, *665*.

II. PERISPORIALES

I. Erysiphaceae

So far as known, the members of this group never develop perithecia under the climatic conditions of the island, and are known only in the oidium stage. Hence, only tentative determinations based on the host can be made. It has seemed best, therefore, to omit them from the present list.

2. Perisporiaceae

3. DIMERIUM GRAMMODES (Kuntze) Garmán.
   On *Crotalaria retusa*. Anasco, *663;* Mayaguez, *648, 662*.
   On *Meibomia barbata*. Anasco, *652;* El Duque, *661*.
   On *Phaseolus adenanthus*. Mayaguez, *660;* Tanama River, *659*.
   On *Vigna repens*. Mayaguez, *536, 653*.
4. DIMERIUM STEVENSII Garman.
   On *Cordia corymbosa*. Mayaguez, *637*.
5. MELIOLA ANDIRAE Earle.
   On *Andira jamaicensis*. Mayaguez, *583*.
6. MELIOLA BICORNIS var. CALOPOGONIS Stevens.
   On *Calopogonium orthocarpum*. Utuado, *614*.
7. MELIOLA DIFFENBACHIAE Stevens.
   On *Diffenbachia sequine*. Mayaguez, *585, 686*.
8. MELIOLA GLABROIDES Stevens.
   On *Sauvagesia erecta*. Maricao, *616*.
9. MELIOLA GUAREICOLA Stevens.
   On *Guarea trichiloides*. Mayagüez, *593*.
10. MELIOLA IPOMOEAE Earle.
    On *Ipomoea batatis*. Mayaguez, *605*.
    On *Ipomoea tiliacea*. Mayaguez, *606*.

11. MELIOLA LONGIPODA Gaill.
On *Cordia borinquensis.* El Yunque, *610.*
12. MELIOLA MAYAGUESIANA Stevens.
On *Palicourea procea.* Mayaguez, *589, 596.*
13. MELIOLA MELASTOMACEARUM Speg.
On *Miconia racemosa.* Mayaguez, *588.*
14. MELIOLA NIGRA Stevens.
On *Laguncularia racemosa.* Mayaguez, *587.*
15. MELIOLA PANICI Earle.
On *Icanthus pallens.* Mayaguez, *579;* El Yunque, *577.*
On *Olyra latifolia.* Maricao, *552.*
On *Panicum glutinosum.* Maricao, *578.*
16. MELIOLA PAULLINIAE Stevens.
On *Paullinia pinnata.* Mayaguez, *598.*
17. MELIOLA PSIDII Fr.
On *Psidium guajava.* Mayaguez, *600, 737, 529;* Maricao, *599.*
18. MELIOLA PSYCOTRIAE Earle.
On *Randia aculeata.* Barceloneta, *607, 608.*
19. MELIOLA PTERIDICOLA Stevens.
On *Adiantum latifolium.* Mayaguez, *582, 620, 581.*
20. MELIOLA SEPULTA Pat.
On *Avicennia nitida.* Martin Pena, *612.*
21. MELIOLA TECOMAE Stevens.
On *Tecoma pentaphylla.* Maricao, *595.*
22. MELIOLA TORTUOSA Wint.
On *Piper peltatum.* Mayaguez, *591.*
23. PERISPORIUM BROMELIAE Stevens.
On *Bromelia pinguin.* Barceloneta, *504;* Mayaguez, *505.*
24. PERISPORIUM TRUNCATUM Stevens.
On *Inga laurina.* Maricao, *601.*
On *Inga vera.* Mayaguez, *533, 602.*

3. Coryneliaceae

25. CORYNELIA PORTORICENSIS Fitzpatrick.
On *Podocarpus coriaceus.* Maricao, *698.*

4. Microthyriaceae

26. MICROPELTIS AERUGINESCENS Rehm.
On *Rourea glabra.* Rio Piedras, *645.*

III. HYPOCREALES

1. Nectriaceae

27. CALONECTRIA ERUBESCENS (Rob.) Sacc.
On *Piper peltatum,* generally associated with a Meliola (*M. Tortuosa?*). Maricao, *592;* Mayaguez, *603, 590.*
28. CREONECTRIA BAINII (Massee) Seaver.
On pods of *Theobroma cacao.* Mayaguez, *no accession number.*

29. CREONECTRIA GRAMMICOSPORA (F. & W.) Seaver.
On dead branch of tree. Maricao, *no accession number.*
30. MEGALONECTRIA PSEUDOTRICHIA (Schw.) Seaver.
On dead branch of tree. Maricao, *731.*
On dead bar of *Cordia macrophylla.* Mayaguez, *678.*
31. SCOLECONECTRIA TETRASPORA Seaver.
On fence post. Mayaguez, *672.*
32. SPHAEROSTILBE COCCOPHILA (Desmaz.) Tul.
On scale insects on *Citrus decumana.* Barceloneta, *728.*

2. Hypocreaceae

33. DOTHICHLOE ARISTIDAE Atkinson.
On *Aristida portoricensis.* Mayaguez, *695.*
34. HYPOCRELLA TAMONEAE Earle.
On *Miconia sp.* Maricao, *472.*
35. HYPOCRELLA TURBINATA (Berk.) Seaver.
On *Adiantum petiolatum.* Mayaguez, *716, 717.*
On *Adiantum pulverulentum.* Mayaguez, *722.*
On *Adiantum sp.* Mayaguez, *718, 719, 720, 721;* Maricao, *723;* Anasco, *724.*
36. HYPOCRELLA GUARANITICA Speg.
On *Inga laurina.* Maricao, *734.*

IV. DOTHIDEALES

37. AUERSWALDIA CECROPIAE P. Henn.
On *Cecropia peltata.* Mayaguez, *569;* Barceloneta, *570.*
38. AUERSWALDIA MICONIAE P. Henn.
On *Miconia* sp. Maricao, *697, 696.*
39. CATACAUMELLA GOUANIAE Stevens.
On *Gouania lupuloides.* Mayaguez, *562;* Maricao, *470.*
On *Gouania polygama.* Maricao, *565.*
40. DOTHIDELLA FLAVA Stevens.
On *Lithacne pauciflora.* Mayaguez, *547, 425.*
41. MYRIOGENOSPORA BRESADOLEANA P. Henn.
On *Andropogon bicornis.* Rio Piedras, *681, 682.*
On *Axonopus compressus.* Mayaguez, *683.*
On *Icanthus pallens.* Tanama River, *686.*
On *Paspalum conjugatum.* Maricao, *684, 685.*
42. PHYLLACHORA ANDROPOGONIS (Schw.) Karst. & Har.
On *Paspalum notatum.* Barceloneta, *558.*
43. PHYLLACHORA BOURRERIAE Stevens & Dalby.
On *Bourreria succulenta.* Barceloneta, *572.*
44. PHYLLACHORA CYPERI Rehm.
On *Cyperus giganteum.* Mayaguez, *576.*
45. PHYLLACHORA ENGLERI Speg.
On *Anthurium dominicense.* El Yunque, *644.*
46. PHYLLACHORA GALACTIAE Earle.
On *Galactia striata.* Barceloneta, *575;* San German, *574.*

47. PHYLLACHORA GRAMINIS (Pers.) Fuckel.
On *Valota insularis*. Barceloneta, *551*.

48. PHYLLACHORA MAYEPEAE Stevens & Dalby.
On *Mayepea domingensis*. Maricao, *567*.

49. PHYLLACHORA MINUTA P. Henn.
On *Paritium tiliaceum*. Catano, *650*.

50. PHYLLACHORA NITENS Garman.
On *Schlegelia brachyantha*. El Yunque, *640*.

51. PHYLLACHORA PERIBEBUYENSIS Speg.
On *Tetrazygia elaeagnoides*. Barceloneta, *636*.

52. PHYLLACHORA PHASEOLI P. Henn.
On *Phaseolus adenanthus*. Tanam River, *659*.

53. PHYLLACHORA ROUREAE Sydow.
On *Rourea glabra*. Mayaguez, *626*; El Yunque, *646*.

54. PHYLLACHORA SECURIDACAE P. Henn.
On *Securidaca virgata*. Mayaguez, *564*; Maricao, *563*.

55. PHYLLACHORA SPHAEROSPERMA Wint.
On *Cenchrus echinatus*. Campo Alegre, *437*.

V. SPHAERIALES

1. Cucurbitariaceae

56. ROSTRONITSCHKIA NERVINCOLA Fitzpatrick.
On *Gesneria albiflora*. Maricao, *699*.

2. Coryneliaceae[7]

[7] The Coryneliaceae are included above under the Perisporiales.

3. Mycosphaerellaceae

57. GUIGNARDIA PIPERICOLA Stevens.
On *Piper medium*. Rio Piedras, *635*.

58. MYCOSPHAERELLA DIDYMOPANICIS Miles.
On *Didymopanax Morotoni*. Maricao, *516*.
On *Didymopanax* sp. Maricao, *515*.

59. MYCOSPHAERELLA PERSEAE Stevens.
On *Persea gratissima*. Yauco, *337*.

4. Pleosporaceae

60. PHYSALOSPORA ANDIRAE Stevens.
On *Andira jamaicensis*. Martin Pena, *566*.

5. Clypeosphaeriaceae

61. LINOSPORA TRICHOSTIGMAE Stevens.
On *Trichostigma octandra*. Yauco, *656*.

6. Xylariaceae

62. NUMMULARIA CINCTA Ferd. & Wing.
On wood. Maricao, *675*.
63. XYLARIA APICULATA Cooke.
On wood. Mayaguez, *674*.
64. XYLARIA ARISTATA Mont.
On dead leaves of *Clusia rosea*. Mayaguez, *677*.
65. XYLARIA AXIFERA Mont.
On fallen herbaceous stems. Maricao, *no accession number*.

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THE FUNGI OF BLACKSBURG, VIRGINIA

W. A. Murrill

During the latter half of July, 1920, the following fungi—over 150 species—were found by the writer in the vicinity of Blacksburg, Virginia, mostly in oak-chestnut groves with white oak predominating. The elevation is 2,200 feet and the underlying rock near the town is Trenton limestone, while on Brush Mountain, a mile or two to the north, the soil had its origin in subcarboniferous shales and sandstones. On account of the excellent season, many valuable field notes and several novelties were obtained, especially of the fleshy forms. Attention is called to observations in connection with *Ceriomyces retipes, Hexagona alveolaris, Vaginata plumbea,* and *Venenarius cothurnatus.*

A. ASCOMYCETES

Bulgaria rufa. More abundant than I have ever before seen it, on fallen dead branches and trunks of white oak in Preston's Woods and elsewhere.

Hypomyces lactifluorum. Common where I found it last year and enjoyed a mess of it mixed with the common *Chanterel.*

Leotia stipitata.

B. HYMENOMYCETES

a. Tremellales

Tremella frondosa.

Tremella mycetophila. On *Gymnopus dryophilus.*

Tremella sparassoidea. Under white oak. See figure and description by Overholts in *Mycologia* for May, 1920.

b. Agaricales

1. Thelephoraceae

Craterellus cornucopioides. Found three times.

Lachnocladium Schweinitzii. Abundant.

Thelephora spp. Three or four interesting species, mostly of the *T. palmata* group.

2. Clavariaceae

Clavaria cristata. Found twice on a hillside in Preston's Woods growing in dense clusters among grass and leaves. Lemon-yellow, with a distinct odor difficult to define, the taste bitterish but not farinaceous.

Clavaria flava. Frequent in shaded situations.

Clavaria fusiformis. Found twice. A splendid typical cluster was collected under *Rhododendron maximum* at the foot of Brush Mountain near Kanode's Mill.

Clavaria inaequalis. Found once.

Clavaria muscoides. A small species growing in moss at the base of a white oak in Preston's Woods. Lemon-yellow throughout, fragile, taste farinaceous and bitterish, odor none.

Clavaria sp. In leaf-mold under an oak in Preston's Woods. Large and beautifully colored, reminding one of a bunch of coral. Rose-pink and flavous to slightly chrome-yellow. Flavor fine, odor none. Dr. Coker has found this species in North Carolina and will describe it.

3. Hydnaceae

Hydnellum zonatum?. Gregarious and abundant on a dry bank on Brush Mountain among roots and weeds. Thin, dry, small, with pale margin and strongly farinaceous odor and taste.

Manina cordiformis. Found in Preston's Woods in a dead spot on a living trunk of pig-nut hickory.

Steccherinum adustum. Common. I found a fine clump on a white oak log.

Steccherinum pulcherrimum. On a white oak log. Large, imbricate, isabelline with fulvous strains on the surface; context tough, sweetish.

4. Xylophagaceae

Merulius tremellosus. On a white oak log.

5. Polyporaceae

Bjerkandera adusta.

Cerrena unicolor.

Coriolus versicolor.

Daedalea confragosa.

Daedalea juniperina. On red cedar stump on the bank of Toms Creek. This rare species was previously known from Kansas, Missouri, Kentucky, and South Carolina, always confined to red cedar.

Daedalea quercina. On an oak stump. A rare species in this locality.

Elfvingia lobata. Abundant on white oak stumps and at the base of living red maple, hickory, white oak, etc. Evidently parasitic, like its northern relative, *E. megaloma.*

Fulvifomes Robiniae. Common on black locust trunks about Blacksburg and at Mountain Lake.

Grifola Berkeleyi. I found three very large specimens, all growing by oak trees.

Grifola flavovirens. On the ground in woods, where I found it many years ago.

Hexagona alveolaris. Common on fallen hickory branches. *H. striatula* was also common on the same host but not on the same actual branch. I think it is undoubtedly only a variety of *H. alveolaris.* In Europe, this species causes a serious disease of the English walnut and we must be prepared to expect it in our walnut and hickory orchards in this country.

Laetiporus sulphureus. Covering an oak stump.

Polyporus arcularius. Frequent on fallen sticks.
Polyporus elegans.
Poronidulus conchifer.
Pycnoporus cinnabarinus. On oak fence rails,—an uncommon host.
Tyromyces lacteus.
Tyromyces semipileatus. On a white oak log.

6. Boletaceae

Ceriomyces affinis. Found twice.
Ceriomyces bicolor.
Ceriomyces chromapes.
Ceriomyces communis. Abundant.
Ceriomyces edulis. Found a few times,—the brown form only.
Ceriomyces fumosipes. Found once or twice.
Ceriomyces griseus. Found several times, usually growing alone, but once near *C. retipes.* The species is very distinct from *C. retipes* and is never bitter, even in old plants.
Ceriomyces retipes. Several beautiful yellow specimens were found in oak groves, none of them resembling *C. ornatipes* in color, and all of them very distinct from *C. griseus.* Careful observations were made on all specimens found, and it was established beyond a doubt that *C. retipes* is decidedly bitter in all stages and therefore unfit for food, while *C. griseus* is edible. The stipe is much the same in both species but in *C. griseus* the reticulations are smaller and more shallow. The tubes, flesh, and surface, as well as taste, are decidedly different in the two plants.
Ceriomyces subglabripes. Found two or three times in grassy oak woods. Pileus reddish-fulvous, glabrous, rugose; flesh lemon-yellow, with taste reminding one of potassium nitrate; tubes and stipe also lemon-yellow.
Ceriomyces sp. Gregarious under white oaks. Fulvous, rugose, 7–10 cm. in diameter; context nutty, white, becoming skin-colored when bruised; tubes lemon-yellow, browning when bruised; stipe yellowish, chaffy, 10–12 × 2–2½ cm. Characterized by numerous scurfy particles on the stipe. I found upon my return that Dr. Coker had recently collected this same species in North Carolina, so I have suggested that he name it and include the Blacksburg locality.
Rostkovites granulatus.
Strobilomyces strobilaceus. Frequent.
Suillellus luridus. Abundant.
Tylopilus felleus. Very common and large. One group was practically white, growing in an opening in the woods. Could they have been bleached?
Tylopilus gracilis.

7. Agaricaceae

Agaricus sp. Only two specimens were found and these were solitary at different points in oak groves.
Armillaria putrida. Found only once.
Chanterel Chantarellus. Abundant.
Chanterel floccosus.

Chanterel infundibuliformis.

Clitocybe adirondackensis. Quite abundant in white oak woods, growing gregariously.

Clitocybe illudens. Frequent about stumps in fields and woods.

Coprinus fimetarius.

Coprinus micaceus.

Cortinarius semisanguineus. Frequent.

Cortinarius sp. Very common in oak woods and found about the same time a year ago. A striking species with fulvous cap and very distant gills. It is usually strongly umbonate when young.

Cortinellus rutilans. Beside a pitch pine stump on an exposed bank on Brush Mountain.

Entoloma commune. Growing on grassy ground under white oaks.

Entoloma Grayanum. Half a dozen plants found growing gregariously in one spot.

Entoloma pallidum. On the ground in oak woods.

Galerula crispa. Found in a straw pile in an open field.

Geopetalum angustatum. Found twice.

Geopetalum petaloides. In an open grassy spot under white oaks. Found only once, but I do not recall having seen it in Virginia before.

Gymnopus dryophilus.

Gymnopus exsculptus. Found on dead wood on Brush Mountain. The margin of the pileus had become nearly black.

Gymnopus platyphyllus. Frequent.

Gymnopus radicatus. I found a large, gray form like *G. longipes,* with nearly glabrous stipe and another just like it, only with a cream umbo. Both were slimy and rugose on the surface.

Gymnopus strictipes.

Hebeloma sp. Gregarious and very abundant in low places under elm, birch, and fir trees on the college campus. Pileus cream-colored, slightly viscid. with mealy odor and taste; stipe milk-white.

Hydrocybe ceracea.

Hydrocybe conica. Growing gregariously in the grass at the edge of woods.

Hydrocybe flammea. Quite common; sometimes very small.

Hydrocybe psittacina.

Hypholoma appendiculatum.

Hypholoma lacrymabundum. Found once.

Inocybe geophylla. Found twice.

Inocybe spp. Probably six species, which I have not determined.

Laccaria laccata. Common.

Laccaria ochropurpurea. Two plants found.

Lactaria Indigo. Found once. Easily recognized by its color.

Lactaria lactiflua. Abundant.

Lactaria piperata. Abundant.

Lactaria scrobiculata. An attractive species having concentric zones and being tomentose on the margin when young. This was found under white oaks in Karr's Woods where I saw it several years ago.

Lactaria subdulcis.

Lactaria spp. One resembling *L. varia,* but with broad, distant gills. Another near *L. cinerea.* Very uniform in appearance and size. In dry, grassy places under white oaks in Preston's Woods.

Marasmius glabellus.

Marasmius oreades. Abundant.

Marasmius rotula.

Marasmius spp. Several which I have not determined.

Melanoleuca alboflavida. Rather abundant in a semi-shaded spot in oak woods, growing in leaf-mold. The specimens are rather above the average size of the species.

Melanoleuca melaleuca. Small, pallid plants growing among grass on an exposed lawn.

Omphalopsis campanella. On an oak stump. Frequent about Blacksburg on both deciduous and coniferous wood. Very abundant at Mountain Lake.

Panaeolus campanulatus.

Panaeolus retirugis.

Panaeolus semiglobatus.

Panellus stypticus.

Pholiota Johnsoniana. Large plants with a ring that falls away and very small plants, growing gregariously, with the ring breaking up as in *H. appendiculatum.* Size very different but the same plant.

Pleuropus albogriseus. Gregarious or cespitose in grassy woods. Spores angular, uniguttulate, $12 \times 7\ \mu$. Previously known from New York and Massachusetts.

Pleuropus obesus.

Pleurotus ostreatus.

Pluteus cervinus. Frequent.

Pluteus praerugosus sp. nov.

Pileus convex to nearly plane, with a slight umbo in early stages, solitary, 3–4 cm. broad; surface glabrous, very rugose, dry, fuliginous, darker at the center, long-striate on the margin; lamellae free, tapering behind, rather crowded, entire on the edges, white until colored by the spores, which are perfectly globose, smooth, with very large nucleus, almost hyaline under the microscope, pinkish in mass, $5\ \mu$ in diameter; stipe slender, nearly equal, pallid, glabrous, 3–4 cm. long, not at all twisted.

Type collected on a dead white oak log in Preston's Woods, Blacksburg, Virginia, July 16–31, 1920, *W. A. Murrill.*

Prunulus sp. Growing in clusters on a dead white oak log.

Psilocybe foenesecii. Common.

Russula albida. Small and rare.

Russula compacta. Pale-fulvous above with a chestnut tint, milk-white below, staining when touched; flesh sweet.

Russula delica.

Russula emetica. Common.

Russula foetens. Abundant.

Russula furcata. Abundant.

Russula nigricans. Found twice, and in both cases soon blackening.

Russula virescens. Abundant. Eaten by box tortoise, which was just leaving the plants, the ground being covered with chips as usual. Evidently he turned to this species when *Vaginata plumbea* was exhausted.

Russula spp. One milk-white all over, cespitose. Another large, with yellow cap, milk-white stem, and almost white gills.

Stropharia semiglobata.

Vaginata farinosa. Once in oak woods and twice on Brush Mountain.

Vaginata parcivolvata. Six or more plants growing near together and bringing up scraps of dirt that resembled volval patches.

Vaginata plumbea. Common in half a dozen varieties, including a large white one, but the fulvous form was most abundant. This last was especially liked by the box tortoise, which was found several times in different parts of oak groves feeding upon it. I was walking early one morning in Broce's white oak grove when I came upon two plants of this variety growing together and a tortoise beside them, which had devoured half of each plant. When I returned thirty minutes later, he had finished them, stems and all, down to the ground, leaving only a few chips that fell from his mouth while eating. He evidently preferred this species, because many specimens were found, either partly or entirely devoured in this manner peculiar to tortoises. Squirrels take the plants up and carry them to a stump, log, or tree. I was able to confirm my observations as to tortoises by watching two or three more at breakfast later in the week. When practically all the specimens of *Vaginata plumbea* in the woods were gone, *Russulavirescens* seemed to be the next choice.

Venenarius Caesareus. Rare.

Venenarius cothurnatus. Three pure-white plants were first found growing gregariously under a white oak in Broce's Woods. Flies sucked their juice while drying and promptly fell over, apparently lifeless. In order to determine if they were really dead, I kept them covered for twenty-four hours,—and still have them with the specimens. The deadly character of this species was demonstrated later by using a "button" found in Preston's Woods, where I first saw the plant growing in abundance several years ago. A few days later, two good, typical plants were collected in the same woods and preserved. All of the specimens found about Blacksburg are white, showing no tendency to vary to darker forms.

Venenarius flavorubescens. Specimens closely resembling this species were found under white oak trees but it seemed difficult to distinguish them satisfactorily from *V. Frostianus.*

Venenarius Frostianus. Abundant.

Venenarius phalloides. Large and small white forms fairly abundant, ordinary dark form rare; also a whitish form with smoky center, and a large, shining, dark-lead-colored form,—the darkest I ever saw.

Venenarius rubens. Very abundant and of immense size, 20 cm. or more in diameter.

Venenarius solitarius. On the ground in woods. Base large and rounded, not radicate; surface white to grayish or reddish, covered with large warts; chlorine odor very decided. Also found the usual form on clay banks.

Venenarius spp. Two species were found that were not recognized, an avellaneous one in Preston's Woods and a pure-white one in exposed sandy soil on Brush Mountain. The latter resembled *V. cothurnatus* but had no boot and did not kill flies.

C. GASTEROMYCETES

Bovistella ohiensis. On a sunny lawn growing in grass. Large, white, covered with numerous small spines and granules, becoming brownish on top with age and isabelline all over when dried. This species is said to be very common in Ohio; I have found it also in New York City.

Crucibulum vulgare.

Geaster hygrometricus.

Lycoperdon cruciatum (*Lycoperdon separans* Peck). Common in fields.

Lycoperdon gemmatum. Occasional.

Lycoperdon spp. Three small species were found that I did not recognize. One was very smooth and white and grew in fields with *L. cruciatum;* another, found rarely in woods, had a smooth, grayish-marbled, reticulate-rimose surface; and the third, occurring frequently in woods, was distinguished by a dense covering of small, whitish to discolored spines.

Scleroderma verrucosum. On the campus in a low, shaded spot.

NEW YORK BOTANICAL GARDEN.

NEW JAPANESE FUNGI

NOTES AND TRANSLATIONS—IX

Tyôzaburô Tanaka

Helminthosporium papaveri K. Sawada sp. nov. in Taiwan Hakubutsu Gakkwai Kwaihô (Journ. of Formosan Nat. Hist. Soc.) No. 31: 129, T. 6, xii, Dec., 1917, and in Bull. No. 128, Agric. Exp. Stat., Gov'nt of Formosa, "Taiwan ni okeru Keshi Byôgai Chôsa" (Diseases of poppy in Formosa) by K. Sawada, pp. 20–22, T. 7, vi, June, 1918. (Japanese.)

Conidiophores fasciculate or solitary, copiously branched, cylindric, many septate, yellowish-brown, 86–130 x 6–7 μ, terminating with a single conidium, after its abstriction a second conidium is formed; conidia cylindric, both ends blunt, 3–10 septate, constricted, yellowish-brown, 22–112 x 7–11 μ.

Parasitic on leaves, stems, peduncles and fruits of *Papaver somniferum.*

On leaves, spots are large, irregular, brown and pierced at the center when fully matured. On stems, the lesions causing rot are brown, and, when they are formed at the lower part, cause wilting of the whole plant; the decay soon appears at the petiole of leaves turning them to a dirty yellowish-brown color. The stem tissues, including cortex, are entirely disorganized and dead; at a certain stage a gray mould is found on the decayed surface. The appearance on the peduncles is similar to that on the stems. When the fruits are attacked the spots are orbicular, yellowish-brown or brown bordered with a blackish-brown periphery, and later develop gray mould from the center, which occasionally appears in concentric zones. No sound seed is produced from the diseased fruits. It is one of the most dangerous diseases of cultivated poppies in Formosa.

Type localities: Taihoku-chô Taihoku, Apr. 25, 1917, Funabiki; Taihoku-chô, Chônaihoshô, Apr. 21, 1917, K. Sawada.

Notes: Additional localities are recorded from Taichû-chô Koroton, June 8, 1918, K. Sawada; Nantô-chô Nantô, June 6, 1918, K. Sawada; Kagichô Chikutôki, Apr. 3, 1918, K. Sawada. (See second paper, p. 21.) After inoculation tests, the damping-off of poppy seedlings is proved to have been caused by the same fungus. This trouble was found by the author in nurseries of southern Formosa.

FUSICLADIUM THEAE K. Hara sp. nov. in Chagyôkawi (Tea Journal) 14^4: 16–17, 1 pl. T. 8, iv, Apr., 1919. (Japanese.)

Acervuli amphigenous, velvety, black; conidiophores filiform, straight or curved, thickened at the base, continuous to 3-septate, brownish at the lower part, light colored and often crooked at the upper part 40–70 x 4–5 μ; conidia terminal, occasionally arising from the crooked edges of conidiphores, cylindric or oblongovate, uniseptate almost at the middle, usually not constricted though sometimes constricted, blunt at the apex, somewhat pointed at the base, straight or curved, colorless or flavescent, 15–28 x 5–6 μ.

On leaves of *Thea sinensis.*

Type locality: Shidzuoka-ken Iwara-gun Kjiro-chô, Nov. 27, 1918, K. Hara.

Illustrations: 2 black and white halftone figures (figs. 8 and 9) showing tufts of conidiphores and conidia.

No *Fusicladium* has been reported on tea plant. This species is distinct from all known species by its almost colorless conidia.

MYCOSPHAERELLA THEAE K. Hara sp. nov. in Chagyôkwai (Tea Journal) 14^5: 9–10, 1 pl., T. 8, v, May, 1919. (Japanese.)

Spots orbicular or irregularly roundish, 3–4 mm. in diam., finally confluent, forming large irregular lesions, at first dark-brown, later becoming cinereous; perithecia epigenous, immersed, later with ostiola erumpent, gregarious, minutely punctiform, black, globose or depressed globose, 50–150 μ in diam.; well carbonaceous, fungoid-parenchymatous, dark-colored, composed of polygonal cells, 3–8 μ across; ostiola papillate or wart-like, with orbicular openings 10–13 μ across; asci tufted, cylindric clavate or oblongovoid, rounded at the apex, pedicellate at the base, octosporous, 30–42 x 6–8 μ; ascospores biseriate, oblong-ovoid or cylindric, both ends subobtuse, uniseptate, not constricted, cells unequal, upper ones being slightly shorter and broader, lower

ones much longer and narrower, every cell binucleate at first, later becoming homogenous, hyaline, 10–13 x 2–2.5 μ.

Parasitic on leaves of *Thea sinensis*.

Type locality: Gifu-ken Ena-gun Kawaue-mura, Apr., 1918, K. Hara.

Illustrations: 4 black and white halftone figures (figs. 5–6) showing spots, perithecia, asci and ascospores.

It differs from *Mycosphaerella punctiformis* in mode of occurrence and in detailed characters of ascospores.

Spots first appear on the surface of leaves as small, round, dark-colored areas of 1 mm. across, which enlarge gradually forming irregular patches of 3–4 mm. in diam., and later becoming confluent forming large irregular dead areas extending towards the leaf margin. Such areas are dark-colored brownish-gray and develop abundant black minute specks on the upper surface, while the lower surface of the leaf remains a dark-brown color.

MYCOSPHAERELLA IKEDAI K. Hara sp. nov. in Chagyôkwai (Tea Journal) 14^5: 10, 1 pl., T. 8, v, May, 1919. (Japanese.)

Perithecia amphigenous or more frequently hypogenous, gregarious or scattered, immersed, globose or depressed globose, apically ostiolate 50–80 μ in diam., wall parenchymatous, consisting of polygonal cells 5–8 μ in diam. across, carbonaceous ostiola papillate or simple, with round openings of 10–12 μ across, asci obovoid or oblong, rounded at the apex, pedicellate at the base or sessile, octosporous, 40–45 x 8–12 μ, ascospores 3-stichous or irregularly polyseriate, oblong-ovoid or cylindric, uniseptate, much constricted, cells unequal, upper ones mostly shorter and broader while lower ones are just opposite, at first granulate, later homogenous, colorless and hyaline, 13.2–16 x 5–5.5 μ.

Saprophytic on leaves of *Thea sinensis*.

Type locality: Shidzuoka-ken Inasa-gun Idaira-mura, Sept., 1918, K. Hara.

Illustrations: 2 black and white halftone figures (figs. 9 and 10) showing asci and ascospores.

M. Ikedai K. Hara differs from the former species in the shape of the asci, arrangement, shape and size of the ascospores. It is

named in honor of Isaji Ikeda, President of the Prefectural Agricultural Society, under whom the investigations were made.

MELIOLA CITRICOLA K. Hara sp. nov. in Shidzuoka-ken Nôkwaihô (Journ. Agric. Soc., Shidzuoka Prefecture) No. 263: 8–9, 1 pl., T. 8, viii, Aug., 1919. (Japanese.)

Young hyphae filiform, delicate, branching, septate, colorless or light colored, 2.5–3 μ across, mature hyphae thick, branching, septate, constricted at septa, often catenulate and easily detached, dark-brown, sometimes nucleate, 4–7 μ thick, detached cells (chlamydospores) ellipsoid or subglobose, 8–15 x 4–7 μ; conidia of *Triposporium* type astellate with 3–4 arms, arms thick at the base, tapering towards the apex and ending in a sharp point, 2–4 septate, 40–60 μ, perithecia globose or depressed globose, 200–230 μ across, wall naked, fungoid-parenchymatous, carbonaceous, brittle, dark-brown, cells 6–12 μ across; ostiola apical, not projecting, with orbicular opening of 15–20 μ across, asci obvate globose or ellipsoid, rounded at the apex, pedicellate at the base, thick walled, octosporous, aparaphysate, 40–70 x 30–40 μ, ascospores ellipsoid ovoid or subfusoid, tapering towards rounded ends, straight or curved, 6–7 transversely septate, often with longitudinal septa, hyaline, 28–45 x 7–12 μ.

Epiphytic on leaves, branches and fruits of *Citrus* spp.

This species appears mostly on the upper surface of leaves producing black or dark gray irregular patches which finally enlarge forming a thick incrustation all over the leaf surface. When fully matured the surface becomes velvety and spotted with minute black bodies and at this stage the black mass begins to peel off from the substratum.

Type locality: Shidzuoka-ken Agricultural Experiment Station, Apr. 25, 1919, K. Hara.

Illustrations: 3 figures (figs. 12–14) in 1 black and white halftone plate, showing perithecia, asci and ascospores.

It differs from *Limacinia theae* P. & H. Sydow & Butl. (Ann. Mycol. 9: 346) in the tapering and curved ascospores, intertwining hyphae without bristles, and in the absence of a particular pycnidial form. *Meliola penzigi* Sacc. resembles the present species in having naked perithecia, but the former is characterized by colored biseriate ascospores having 3 transverse and 1–2 longitudinal septa, while the latter is distinguished by heaping

non-seriate ascospores ellipsoid in shape and usually 7-septate, in size three times as large as the former. *Meliola camelliae* and *Meliola citri* do not agree with the present species in their bristled perithecia and in the size and shape of the ascospores.

GLOEOSPORIUM CARTHAMI Hori & Hemmi comb. nov. in Byôchû-gai Zasshi (Journ. Plant Prot.) 6^3: 189. T. 8, iii, March, 1919. (Japanese.)

Marsonia carthami Fukui, ex Tanaka in Mycologia 9^3: 169, 1917.

Hemmi points out that the fungus has typically 1-celled ascospores, and should correctly be placed under *Gloeosporium* (subgen. *Colletotrichum*). In a later publication of the same author (Annals of the Phytopath. Soc. of Japan, 1^2: 1–11, March, issued June, 1919) the detailed characters of this fungus are thoroughly given in German. The disease was reported from Sapporo and Hyôgo, and is pretty serious in early summer months. The temperature relations of the development of this fungus are also given by Hemmi in Sapporo Nôrin Gakkwai-hô 10^{47}: 40, 49–52, Dec., 1918.

BUREAU OF PLANT INDUSTRY,
WASHINGTON, D. C.

NOTES AND BRIEF ARTICLES

[*Unsigned notes are by the editor*]

Readers of MYCOLOGIA are invited to contribute to this department personal news items and notes or brief articles of interest to mycologists in general. Manuscript should be submitted before the middle of the month preceding the month in which this publication is issued.

Dr. G. R. Bisby, formerly of the University of Minnesota, has removed to Winnipeg, Canada, where he is professor of plant pathology at the Manitoba Agricultural College.

Mr. Paul A. Murphy, so well known for his work on potato diseases, is now located in the Division of Seeds and Plant Diseases, Royal College of Science, Dublin, Ireland.

Dr. W. A. Murrill lectured at Manchester, Vermont, July 8; examined types of *Poria* at Albany, July 9; and lectured again at Yama Farms, July 10. He is much indebted to Dr. House for assisting him in getting at the type specimens of *Poria*.

Mr. Freeman Weiss, formerly under the employ of the Department of Agriculture and the Minnesota Agricultural Experiment Station, investigating cereal diseases, has been appointed assistant pathologist in the Department of Agriculture and is engaged in investigating the potato-wart disease.

Mr. N. Rex Hunt has been transferred from the Office of Forest Pathology Investigations, Bureau of Plant Industry, to the Federal Horticultural Board to assist in the eradication of the potato-wart disease.

Dr. Charles Drechsler has taken up the investigation of vegetable decays and decay-producing organisms as an employee of

the Office of Cotton, Truck, and Forage Crop Disease Investigations, with headquarters at Brooklyn, New York.

Mr. D. C. Neal has accepted the position of plant pathologist for the Mississippi Agricultural Experiment Station, after resigning a similar position with the Georgia State Board of Entomology.

Mr. C. M. Tucker, recently graduated from the University of Missouri, has accepted a position with the Extension Division of the Florida College of Agriculture and will conduct extension work on the control of watermelon diseases.

Dr. F. Kølpin Ravn, of Denmark, died suddenly of blood poisoning, on May 25, at the home of his wife's parents at East Orange, New Jersey.

Mr. Julius Matz, who for the past year held the position of assistant pathologist at the Insular Experiment Station at Rio Piedras, Porto Rico, has been appointed chief of the Division of Botany and Plant Pathology at the same station.

Tagging instead of blazing trees is strongly recommended by Weir in *Phytopathology* for July, 1920,—with evidence to support his opinion.

Serious injury to Rhododendrons and Azaleas in the Northwest by *Armillaria mellea* was noted by Schmitz in the July number of *Phytopathology*.

On a recent visit to Albany, typical specimens of *Poria ornata* Peck and *Poria subacida* Peck were compared and the species found to be identical.

A list of ascomycetes new to Indiana, by Bruce Fink and Sylvia Fuson, appeared in the *Proceedings of the Indiana Acad-*

emy of Science for 1918, pp. 264–275. It contains about 140 species, including 2 new ones, *Pyrenopsis fuscoatra* Fink and *Verrucaria sordida* Fink.

Rusts on conifers in Pennsylvania are described and figured by J. F. Adams in Bulletin 160 of the Pennsylvania Agricultural Experiment Station, which also contains an important paper by the same author on sexual fusions and the development of the sexual organs in the Peridermiums.

Mrs. John R. Delafield sent in many interesting specimens of fungi from the vicinity of Buck Hill Falls, Pennsylvania, during her residence there the past summer and autumn. Many of them were accompanied by beautiful colored figures, as well as by valuable field notes.

Reddening of the leaves of *Rhus copallina* in New England has been ascribed to the action of *Exoascus purpurascens*. In Italy, Traverso has investigated two diseases of *Rhus coriaria*; one causing leaf coloration and die-back, ascribed to *E. purpurascens*, and the other appearing in minute, discolored spots caused by *Septoria rhoina.*

Experiments on the control of eelworms in Narcissus growing out-of-doors were reported a year ago by J. K. Ramsbottom in the *Journal of the Royal Horticultural Society.* Experiments with manures and chemical sterilizers were alike ineffective in freeing soils from nematode infection or in protecting crops from nematode attack. Experimentation on different crops with a view to securing a rotation that would avoid or minimize nematode attack showed that this organism may become so adapted to a particular host species as not to attack with severity other host species.

In a bulletin published in 1919 by the Trinidad Department of Agriculture, J. B. Rorer discusses the fungous diseases of the avocado, or alligator pear. He states that the only serious dis-

ease found on the fruit is the so-called anthracnose, which is identical with or closely related to the anthracnose of mango. Avocado die-back is of frequent occurrence throughout the Colony. This is due to *Diplodia cacaoicola*, which also causes die-back of cacao and of rubber. It is thought to enter by way of very young tissues through wounds made by the anthracnose fungus, growing then rapidly down the tree and killing back the shoots for a distance of two or three feet from the tip. The same fungus also attacks budded avocados.

Phomopsis juniperovora, a new species causing blight of nursery cedars, is described and figured by G. G. Hahn in *Phytopathology* for April, 1920. The disease is known in New York, Pennsylvania, and several states of the middle West.

Observations on some common and important diseases of the rhododendron on the Pacific Coast, by Henry Schmitz, appeared in *Phytopathology* for May, 1920. *Sporocybe Azaleae* attacks the buds and causes them to rot, while *Melampsoropsis Piperiana* attacks the leaves, producing the so-called "rust." Other fungi attacking the leaves are: *Lophodermium Rhododendri, Cocomyces dentatus, Coryneum Rhododendri, Sphaerella Rhododendri, Pestalozzia Guepini,* and *Cryptostictis* sp.

A note on our native barberry in connection with wheat rust, contributed by Stakman and Krakover to the May number of *Phtopathology*, mentions infected bushes found near Blacksburg, Virginia, May 18, 1919, by Fromme and Massey. It might be of interest to say here that in 1897 I made an extended survey of the distribution of *Berberis canadensis* about Blacksburg and found much of it infected with rust. Also, that the most badly rusted wheat I ever saw was found growing about limestone and shaly knolls covered with barberry bushes. Quantities of this material in various stages was taken by me to Cornell in the fall of 1897 and used there year after year in class demonstration and laboratory work.

An interesting article on the Phyllosticta blight of snapdragon, by Miss Edwina M. Smiley, appeared in *Phytopathology* for April, 1920. Little has been done as yet on the control of this disease, but the author advises the following precautionary measures. First, the removal of all debris from infested benches before new plants are put in and the use of only healthy plants for setting. The second precaution is the practice of soil watering, with proper ventilation of the house. Finally, snapdragons should be grown in cool houses, for the plants will do well in an average temperature of 15° C., a temperature at which the fungus can not thrive as a parasite.

A drain-blocking fungus was noted by A. Lorrain Smith in the *Transactions of the British Mycological Society* for April, 1920. In September, 1919, about fifty pounds of fungous material were taken from a sewer-pipe in London, thirty feet below the surface of the ground, and determined by Mr. Rea as *Fomes ulmarius*, which grows on elm trees. Since elm roots, like those of poplars and willows, often travel long distances in search of water, it is probable that the Fomes was connected in some way with elm roots or their remains in the pipe or adjacent soil. The fungous material was found in four different places and was removed at great cost.

Professor F. S. Earle spent several days at the Garden the past summer consulting the library in connection with his work on sugar-cane diseases in Porto Rico. Speaking of the mosaic, he said that he had proved by careful experiments that this very serious disease can be controlled by using only healthy seed and eradicating all infected plants as soon as they appear in the field. Something immensely interesting regarding the nature of this mosaic was also disclosed, which will soon appear in print. Referring to root-rot of sugar-cane, he said that all that had been written about *Marasmius Sacchari* in this connection was pure fiction, because it had nothing to do with the rot.

Crown gall has been recently investigated by Levin and M. Levine with a view to determining its analogy to animal cancer. Some of the plant tumors studied grew slowly and were not injurious, while others were malignant, and the appearance of highly differentiated tissues subsequent to and participating in the development of a malignant tumor is, it is claimed, unknown in animal cancer. The conclusion arrived at is that a fast-developing simple crown gall presents much analogy to animal cancer and offers ideal material for the cellular study thereof. The structure of the growing central part is identical in practically all crown galls thus far investigated. This structure, therefore, represents only one type among the large number of pathological processes grouped under the name of cancer. The study of crown gall, however, affords no secure ground for a claim that all human cancers are formed through the activity of an identical organism.

The following fungi were collected by W. A. Murrill on July 22, 1920, at Mountain Lake, Virginia, about 4,000 feet above sea-level: *Cordyceps militaris; Exobasidium Azaleae; Lachnocladium Schweinitzii; Laccaria laccata; Omphalopsis campanella; Gymnopus platyphyllus; Russula foetentula, R. foetens, R. furcata, R. flava,* and several other species; *Chanterel Chantarellus, C. infundibuliformis, C. minor; Vaginata plumbea* in several varieties; *Venenarius Frostianus; Crucibulum vulgare; Lycoperdon cruciatum; Ceriomyces communis; Fuscoporia ferruginosa* on dead chestnut; *Coriolus abietinus* on hemlock; *Inonotus radiatus* on birch; *Ganoderma Tsugae; Elfvingia megaloma; Elfvingiella fomentaria;* and *Pyropolyporus igniarius* in black, aborted forms on trunks of *Betula alleghaniensis,* as it occurs in Maine on *Betula lutea.*

Two papers on mushrooms by L. C. C. Krieger have recently been published under the auspices of Dr. Howard A. Kelly, of Baltimore, Maryland. One was a beautifully illustrated article in the May number of the *National Geographic Magazine* on the "Common Mushrooms of the United States," which has already

been very widely distributed; and the other a small pocket key to the genera of the gill mushrooms published as a chart, which is folded and bound for use in the field. The characters of the genera are shown for the most part by small pen sketches of typical species, and there is a brief illustrated glossary of terms relating to structure. This key may be obtained from The Norman, Remington Company, of Baltimore, for one dollar. The great advantage of any chart over a book is the opportunity it gives to compare a specimen at a single glance with every figure on it.

Notes on the Lower Basidiomycetes of North Carolina, by W. C. Coker, appeared in the Journal of the *Elisha Mitchell Scientific Society* for June, 1920. This is a continuation of the handsomely illustrated articles on North Carolina fungi which have been appearing for some time in the above-mentioned journal, and it contains descriptions and figures of many species in a number of different genera, such as *Gymnosporangium, Septobasidium, Exidia, Tremella, Tremellodendron, Sebacina, Dacrymyces,* and *Calocera.* The following species are described as new: *Ditiola Albizziae, Dacryopsis ceracea, Dacrymyces fuscominus, D. pallidus, D. Ellisii, Tremella subanomala, T. carneoalba, T. aspera, Naematelia quercina, Exidia Beardslei, Platygloea caroliniana,* and *P. Lagerstroemiae.*

"A Critical Study of the Slime-molds of Ontario," by Mary E. Currie, appears in the *Transactions of the Royal Canadian Institute of Toronto* for 1919. The paper gives interesting descriptive and distributional notes of 118 species and varieties, in 29 genera; 47 species and varieties being recorded from Ontario for the first time, 36 being new to Canada, and 5 new to North America. The following were noted as parasites on fungi: *Badhamia foliicola* Lister, *B. magna* Peck, *B. utricularis* Berk., *Physarum flavicomum* Berk., and *P. polycephalum* Schw. The following nine were found at times fruiting on the leaves or stems of grasses or herbaceous plants, and in some cases at least are injurious to these plants: *Diachaea leucopoda* Rost., *Diderma*

effusum Morg., *D. testaceum* Pers., *Didymium squamulosum* Fries, *Fuligo septica* Gmel., *Leocarpus fragilis* Rost., *Mucilago spongiosa* Morg., *Physarum cinereum* Pers., and *P. sinuosum* Weinm.

The insect transmission of diseases is treated at length in an article of the greatest importance by F. V. Rand and W. D. Pierce in *Phytopathology* for April, 1920. According to the authors, the investigations of the past three decades have completely revolutionized our view of the rôle of insect transmission in both plant and animal diseases. Among the points to be studied are the following. It is necessary to determine on or in what part or parts of the body the contagium is carried; whether the transmission is mechanical or biological; how soon after taking up an infective principle transmission is possible; how long the insect remains infective; whether an infected larva may retain the contagium through its metamorphosis; whether the contagium can be transmitted to the offspring, and if so, for how many generations; whether the offspring can transmit the disease at any stage of its development; whether an infected insect remains infective after a period of feeding on non-susceptible hosts; and whether the contagium winters over in the insect. The mere fact, however, that the contagium of a disease is found in or on the body of an insect should in no case be taken as final proof of an insect relation to transmission. In many diseases an inoculating needle, a piece of wood, or *anything* which happens to come into contact with the diseased tissues will carry upon it some of the contagium. *The final criterion, then, should be the actual transmission of the disease under controlled conditions simulating as nearly as possible those found in nature.*

Artificial and insect transmission of sugar-cane mosaic is discussed by E. W. Brandes in a reprint from the *Journal of Agricultural Research* issued May 1, 1920. It is considered by the author as proved that the cell sap of diseased plants is infectious when introduced in the proper manner and that the disease can be transmitted by insects. Just what insects are responsible for

dissemination in the cane regions remains to be proved. The failure of the sharp-headed grain leaf-hopper to transmit the disease under the conditions of these experiments is surprising. This insect is very common on cane in Louisiana, and as a result of field observations suspicion was directed toward it from the first. Other leaf-hoppers are now being tested. The successful experiments with the corn aphis are of great interest scientifically, but it is believed that transmission of mosaic is restricted to this insect or to other aphids more abundant on cane. *Aphis maidis,* however, has been reported on sugar cane from practically every sugar-cane region in the world. That cane mosaic is analogous with other mosaic diseases is brought out by a number of facts, aside from the visible signs of the disease. As in many other mosaics, the infectious material does not seem to be highly specialized, but may attack other plants of the same family. The cell sap of infected plants contains some organism, not visible by ordinary means, which is capable of inducing the disease when injected into healthy plants. Leaves which are mature at the time of inoculation never show any signs of mosaic. This fact, typical of all mosaics, has been brought out in all inoculation experiments with sugar-cane. The disease can be transmitted by certain sucking insects. There is no known period of saprogenesis in the existence of the virus. Seed transmission of the virus is one of the phenomena concerning which divergent results have been recorded for the various mosaic diseases. This point has not been definitely settled for sugar-cane mosaic, but mosaic sorghum plants failed to produce mosaic progeny in two experiments.

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